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16. ABSTRACT

This periodical is published to inform air pollution personnel of the Environmental Protection Agency (EPA), and others, of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Translations are cited with their sources whenever possible. The subject fields are as follow: Emission Sources; Control Methods; Measurement Methods; Air Quality Measurements; Atmospheric Interactions; Basic Science and Technology; Effects-Human Health; Effects-Plants and Livestock; Effects-Materials; Economic Aspects; Standards and Criteria; Legal and Administrative; Social Aspects; and General and Miscellaneous. All abstracts are listed under one of the above subject fields. A subject and author index are included. This issue contains abstracts 2286 - 3564.

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U. S. Department of Health, Education, and Welfare
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2286 APTIC NUMBER 20517

Barbeito, Manuel S. and Gardner G. Gremillion
MICROBIOLOGICAL SAFETY EVALUATION OF AN INDUSTRIAL REFUSE INCINERATOR. Appl. Microbiol., 16(2):291-295, Feb. 1968. 6 refs.

An industrial refuse incinerator was tested to determine minimal operating temperatures required to prevent release of viable microorganisms into the atmosphere. A liquid suspension of Bacillus subtilis var. niger spores was disseminated into the firebox as an aerosol, and dry spores mixed with animal bedding were dumped into the firebox. The minimal requirement for wet spores was 575 F for the firebox air temperature and 385 F for the firebrick refractory lining. When dry spores were used, these temperatures were 700 and 385 F, respectively. Although internal air temperatures of incinerators in continuous operation generally average 1200 to 1700 F, any one or combination of the following factors may interfere with the necessary time-temperature exposure of airborne microorganisms required for sterilization: temperature gradients caused by intermittent use, linear velocites that exceed the incinerator design and thereby reduce retention time, internal conveyors, automatic vibrating grates, charging beyond incinerator capacity, moisture content of refuse, height of stack, and type of refractory lining. (Author abstract modified)

2287 APTIC NUMBER 20736

Bennett, Raymond P.
ENERGY FOR THE FUTURE. Combustion, 41(10):8-12, April 1970. (Also Phasco News, 22(8).)

Electrical generating requirements for the next 25 years are forecast and the various sources of raw energy are analyzed to obtain an estimate of their proportionate applicability during that period. It is predicted that coal will lose its high percentage of the market but will still provide a significant quantity of the raw energy requirements. Generation by natural gas will grow at a much slower rate than in the past, due to competition from other consumers and a limited proven reserve. Oil will provide energy to coastal utilities but will be limited to coastal areas by transportation costs and will not be a dominant energy source. Hydro will diminish in importance and areas now predominantly hydro will turn to nuclear and coal in the future. Nuclear energy will achieve a dominant role in electric utility generation.

2288 APTIC NUMBER 21320

Bignardi, L. and M. Mastrolilli
ABOUT THE SMOKE EMISSION OF HEATING PLANTS. (In tema di emissione solida nei fumi degli impianti termici). Text in Italian. Termotecnica (Milan), 24(2):99-104, Feb. 1970. 16 refs. (Presented at the 24th National Congress of the ATI, Bari, Italy.)

Soot particles emitted by furnaces are of two principle types: spherical particles of elemental carbon 0.01-0.1 micron in size, and particles of irregular size and shape (1-200 micron) with a high content of carbon, which are the products of the incomplete combustion of fuel droplets. The basic methods for measuring the size of these particles may be classified as optical (the Ringelmann and Bacharach methods) and the weight-determination method. The latter consists of aspirating a part of the soot-containing gas through a filter and determining the volume of the gas and the weight of the filter before and after sampling, which gives a measure of the mass per unit volume of the solid particles contained in the gas. The Shell Carbon Determination Apparatus (SCDA) was used in a laboratory at Genoa, Italy, in a series of test exploring the possibility of determining the content of solid particles in a known volume of gas by subjecting it to an oxidation process at high temperatures. Four types of soot were used for the experiments: activated animal charcoal, wood charcoal, soot taken from the base of a smokestack, and from a shaft leading to the smokestack. For all types of samples, the lowest percentage of error was experienced for soot particles in the range 10-20 mg. Below 10 mg, the values obtained by weight determination were more prone to error, while for particles above 20 mg in weight there were errors connected with the sampling procedure that assumed greater importance. For the range of particle sizes studied, the error for animal charcoal was usually below 2.5%, while for the other 3 types, the error increased as the carbon content of the particles decreased.

2289 APTIC NUMBER 21187

Bloebaum, W. D., Jr.
TRANSPORTATION OF LNG FOR REMOTE OR INTERRUPTIBLE SERVICE. (Inst. of Gas Technology, Chicago, Ill, Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 9p. (April 7-12, Paper 6-40).

Over-the-road equipment is described for supplying liquefied natural gas as base load supply to remote communities, during interruption of normal gas supply, or as a fuel on mobile equipment. Important design factors for an LNG vehicle are maximum capacity, type of insulation, state and federal highway regulations, safety requirements, ease of operation, and choice of a pressure transfer or an unloading pump. A 6000-gal. cryogenic tanker now in use is described, and its relatively low overall cost of about $.22 per MCF per 100 mi. indicates the favorable economics of LNG transportation to remote sites. An 11,000-gal. tanker has been designed which brings the cost down to $0.12 per MCF per 100 mi. A unit in use to supply gas when normal pipeline supplies are interrupted can provide pressures up to 250 psig automatically without an operator and without an external power source. Specially-designed fuel systems are available to supply natural gas for either reciprocating or turbine engines on mobile equipment. The tanks are designed to withstand shock loads and exposures of daily operation. Vacuum-insulated, truck-mounted service tankers transfer fuel from the primary storage site to the vehicles to be fueled.

2290 APTIC NUMBER 20562

Bollen, W. B.
PROPERTIES OF TOPP BARKS IN RELATION TO THEIR AGRICULTURAL

UTILIZATION. Forest Service, Portland, Ore., Pacific Northwest Forest and Range Experiment Station, Forest Service RP-PNW-77, 36p., 1969. 82 refs.
CFSTI: PB 185347

Possible agricultural uses of large volumes of tree bark are discussed as solutions to the problem of waste bark disposal; current disposal methods by most mills involve burning which creates a significant problem of smoke and particle fallout in mill areas. The decomposition and fate of bark in soil is reviewed, as well as the effect of bark on plant growth. The former belief that tannins, resins, and other wood extractives have a toxic effect on plants when wood residues are added to soil is considered largely erroneous. Bark may be processed in various ways to enhance its agricultural value. Ammoniation is a relatively new way of fortifying the bark with nitrogen, which is vital to its successful use on or in soil. Composting speeds the recycling of nutrients and stabilizes bark while it overcomes its nitrogen deficiency. Other processing may include drying, grinding, screening, pelletizing, adding fertilizers or pesticides, and stabilizing to satisfy the nitrogen demand of the microbial population. The use of bark for mulching, for soil conditioning, and as a component in soil mixes is treated at some length as constituting three of its principal agricultural applications. Other uses are more briefly discussed: facilitating drainage of agricultural land; bedding material for animal and poultry, base material for composting food processing wastes; backfill for septic tank drains; filter bed material for effluent disposal; road and highway slope stabilization; amelioration of forest soil properties after timber harvest; and improving water quality in municipal watersheds.

2291 APTIC NUMBER 20451

Boubel, R. W. and L. A. Pipperton
THE OXIDES OF NITROGEN AND UNBURNED HYDROCARBONS AS COMBUSTION PRODUCTS. (Stickoxide und unverbrannte Kohlenwasserstoffe als Verbrennungsprodukte). Text in German. Oel Gasfeuerung, vol. 11:164-168, Feb. 1966. 12 refs.

The influence of various parameters on the formation of nitric oxide, nitrogen dioxide, and unburned hydrocarbons was studied. Four fuels with equal hydrocarbon fraction but different molecular structure (benzene, cyclohexane, hexane-1, and hexane) were used. Three different air/fuel ratios and three different loads were used. Combustion experiments with and without quenching effect were conducted. A total of 80 test series was performed. The emission of unburned hydrocarbons depends on the specific load in the combustion chamber, on the amount of excess air, on the molecular structure of the fuel compounds, and on the interaction between fuel composition and quantity of excess air. Nitrogen dioxide emission was also influenced by the molecular structure and the quantity of excess air. Nitrogen oxide emissions reached a maximum with minimum quantities of unburned hydrocarbons in the waste gases.

2292 APTIC NUMBER 21383

Bowen, H. J. M.
ELEMENTARY CYCLES AND POLLUTION. Missouri Univ., Columbia, Proc. Missouri Univ. Second Annu. Conf. Trace Substances Environ. Health, Columbia, Mo., 1968, p. 171-179. 9 refs. (July 16-18.)

Global chemical contamination or pollution resulting from human activities is discussed. The two main air contaminants, resulting from oil and coal burning, are carbon dioxide and sulfur dioxide. The CO2 contamination is global, since tracer studies have shown that the half-life of a CO2 molecule is about 4 years. However, no measurable biological consequences have resulted from the amount of CO2 in the atmosphere. Sulfur dioxide pollution is mainly a local problem, since the half-life of an SO2 molecule is of the order of days. The natural rate of formation of SO2 has not been measured. Many workers have shown that SO2 from large cities has an adverse effect on vegetation. More information is needed about elements which may cycle through the atmosphere, notably selenium and mercury, neither of which have yet been detected in the air. The mathematics of complex cycles, such as the carbon cycle, need further clarification so that the effects of increasing CO2 contamination may be predicted. Soil and water pollution are also discussed.

2293 APTIC NUMBER 21031

Brocke, W.
THE MAIN SOURCES FOR SO2-EMISSIONS. (Schwerpunkte der SO2-Emissionen). Text in German. VDI (Ver. Deut. Ingr.) Ber., no. 149:98-109, 1970. 26 refs.

Analysis of the emission sources for sulfur dioxide has shown that emissions will continue to increase over West Germany and in particular the Ruhr Valley until the year 2000. SO2 is estimated to increase from about 3.65 million tons in 1969 to 4.5 million tons in 1980. Traffic and sulfuric acid plants will decrease their emissions, as well as domestic heaters, but power iron ore sintering plants will be major SO2 emission sources. To control these emissions, the sulfur content in heavy fuel oil and to a lesser extent in hard coal must be reduced. In industrial centers only low-sulfur or sulfur-free fuels should be used. In hard coal-fired and sintering plants the wasted gases ought to be desulfurized. Selection of an adequate process should not only reduce the SO2 emissions but also fluoride compounds, the oxides of nitrogen and polycyclic aromatics.

2294 APTIC NUMBER 21594

Chass, Robert L. and Ralph E. George
CONTAMINANT EMISSIONS FROM THE COMBUSTION OF FUELS. J. Air Pollution Control Assoc., 10(1):34-43, Feb. 1969. 5 refs. (Presented at the Air Pollution Control Assoc., Annu. Meet. 52nd, Los Angeles, Calif., June 21-26, 1959.)

The emissions of air contaminants from the burning of fuel oil

present a serious air pollution problem in Los Angeles County. Most industrial plants and steam-electric generating power plants are equipped to burn both fuel oil and natural gas. If all these plants were to burn fuel oil with an average sulfur content of 1.5%, the resultant emissions would be 320 tons of sulfur dioxide, 165 tons of nitrogen oxides, and 30 tons of combustion contaminants per day. If natural gas was used exclusively, such emissions would be reduced to 0.1 ton/day of SO2, 120 tons of nitrogen oxides, and 3 tons of combustion contaminants. Although oil refineries burn only a third as much fuel oil as power plants, their combined fuel usage is greater than that of power plants. An investigation and stack testing program was initiated for other industrial sources. All the stacks were tested for combustion contaminants, aldehydes, nitrogen oxides, SO2, sulfur trioxide, hydrocarbons, carbon monoxide, carbon dioxide, and oxygen. Results are presented in tabular form. The direct control of power plant emission has been approached from three aspects: treatment of the fuel, boiler modification, and treatment of the effluent. The substitution of natural gas for fuel oil would eliminate particulate matter and sulfur compounds, and greatly reduce the nitrogen oxides from the stack effluent.

2295 APTIC NUMBER 21250

OXIDES OF NITROGEN ASSUME NEW IMPORTANCE IN AIR POLLUTION.
Clean Air Quart., 6(1):1-4, March 1962.

The two oxides of nitrogen of concern in an air pollution area are nitric oxide (NO) and nitrogen dioxide (NO2). These participate in the photochemical reaction that causes smog. In the discharge gases from combustion, the oxides mostly are in the form of NO; these may be oxidized to NO2 in the atmosphere. Effective control of hydrocarbons would result in a marked decrease in several of the smog effects. During summer months, motor vehicles contribute almost two-thirds of the oxides of nitrogen; during the winter, they contribute only one-half. More knowledge is needed in the role of oxides of nitrogen in smog reactions and on the effects to human health.

2296 APTIC NUMBER 21150

Closner, J. J.
LNG STORAGE WITH PRESTRESSED CONCRETE. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 15p. 1 ref. (April 7-12, Paper 5-32).

Prestressed concrete is being used on liquefied natural gas storage facilities totalling more than 2,600,000 barrels, and it offers a number of options with respect to siting and insulation arrangements. When tested at liquid nitrogen temperature, concrete increases in strength from two to three times its room temperature strength, while the high carbon prestressing steels are not adversely brittle when subjected to low temperature. Whether the tank is designed for an internal or an external insulation system, the wall section is vertically and circumferentially prestressed, thus creating a two-way system that places the concrete in compression to offset the hydrostatic loads created by the LNG, internal pressures, and temperature stresses. For exterior insulated tanks a steel barrier system is incorporated with the prestressed concrete wall. Descriptions and illustrations are provided for the facilities at Hackensack, Nantes, Barcelona, Staten Island, and Philadelphia.

2297 APTIC NUMBER 20449

Connaughton, Chas A.
FOREST SERVICE MANUAL, PORTLAND, OREGON. TITLE 5100-FIRE CONTROL. Region 6, Suppl. 45, 12p., Dec. 1969.

Slash disposal instructions are presented and include vegetative material, such as cull logs, blasted or pushed-out stumps, chunks, broken tops, limbs, branches, rotten wood, damaged brush, damaged or destroyed reproduction, and saplings or poles which are created or disturbed by any type of vegetative cutting, clearing, construction, or cultural treatment. There are four general methods of slash treatment: prescribed burning; disposal; rearrangement; and supplemental protection. Prescribed burning is defined as planned burning of areas under certain climatic conditions with prepared control lines. Disposal includes piling and burning, burying, or physical removal from the site. Rearrangement is a change in form and/or distribution as by lopping, disking, crushing, scattering, or chipping. Supplemental protection means the furnishing of additional men and/or equipment over and above normal forces in lieu of disposal to meet protection standards. Slash treatment in any particular Key Use Area must consider the needs of all the resources. For example, in timber Key Use Area it may be necessary to leave small amounts of slash and a number of snags for wildlife protection. Treatment of a slash in such Key Use Areas as Wilderness Key Use, Recreation Key Use, Timber Key Use, Range Key Use Areas (meadows and grass areas where timber production is not planned), Watershed, and in wild life habitats is presented.

2298 APTIC NUMBER 20450

Connaughton, Chas. A.
FOREST SERVICE MANUAL, PORTLAND, OREGON. TITLE 5100-FIRE CONTROL. Region 6, Suppl. 44, 17p., Sept. 1969.

Instructions for slash burning in polluted (Designated Areas) and unpolluted forest areas are given. Most favorable conditions for burning in the fall occur two days or more after rain has moistened the bottom of the duff layer in both slash and adjoining green timber. Fuel moisture stick readings of more than 14% in the slash is favorable for satisfactory burning. When slash is within 60 miles of the Designated Area, the specific elements of Smoke Drift Restrictions and the more general elements of Air Quality Firing Considerations apply. No slash fires are permitted with smoke drift toward Designated Area and an upwind distance of less than 10 miles outside the Designated Area. With upwind distances of 10 to 30 miles, burning is limited to 1,500 tons of available fuel per 150,000 acres; in upwind distances of 30 to 60 miles, burning is limited to 3,000 tons of available fuel per 150,000

acres. There are no acreage restrictions at upwind distances of more than 60 miles. Similar restrictions are given for conditions when the smoke will be mixed through a deep layer at the Designated Area and when the smoke hovers above a stable layer over the Designated Area. At any slash burning operation, the objective is to vent most of the smoke to high elevations and to minimize the amount of drift smoke from residual fires that enter Designated Areas. Burning shall start in the morning if it is completed in less than 12 hours and in the evening if it lasts longer than 12 hours. Cured material is favored for burning. Slash units should be fired as rapidly as possible. If the top of a stable layer is no more than 1,500 feet above the slash, the latter should be burned intensely; if the distance is larger, burning should be delayed. Burning at elevations above stable may result in good smoke dispersion.

2299 APTIC NUMBER 21380

Crane, G. B., D. R. Goodwin, and J. F. Rook
ATMOSPHERIC EMISSIONS FROM WET-PROCESS PHOSPHORIC ACID MANUFACTURING. Preprint, National Air Pollution Control Administration, Washington, D. C., 19p., 1969.

The raw materials, chemical reactions, and plant design for the manufacture of wet-process phosphoric acid are described, and a flow diagram is given. All such plants emit SiF_4 and probably to a lesser extent HF. The digester where phosphate rock is decomposed by sulfuric acid is the main source of fluoride emissions; the evaporator where the phosphoric acid is concentrated is a second source; and the filter for the reaction slurry, a third. Other sources are vacuum and flash evaporator hot wells, acid splitter boxes, sumps, and phosphoric acid tanks. Modern designs for emissions control include provisions for sending the various streams to scrubbers adapted to handle each stream. Spray-crossflow packed scrubbers, venturi scrubbers, and others are suitable for these applications. Summaries of the results of a stack testing program carried out at 10 plants are given. It is concluded that it should be possible to operate these plants within acceptable emission ranges at the least if the plants are designed, operated, and maintained to prevent or collect emissions.

2300 APTIC NUMBER 20479

Dadykin, V. P., L. N. Stepanov, and V. Ye. Ryzhkova
SOME DATA ON VOLATILE (OXYGEN-CONTAINING) COMPOUNDS RELEASED BY VEGETABLES. Kosmich. Biol. Med., 1(6):48-52, 1967. 12 refs. Translated from Russian. Joint Publications Research Service, Washington, D. C., 7p., March 14, 1968.
CFSTI: JPRS 44732

Most volatile substances released by plants are physiologically active. Since many of the substances have a strong toxic effect, the creation of artificial, closed bioengineering systems will require a proper knowledge of both the composition and quantity of volatile plant discharges. If this factor is not taken into account, the danger exists of accumulating the compounds in system atmospheres in quantities above admissible levels. The present study used gas chromatographic techniques to determine the quanity of the substances released by the leaves of vegetables (radishes, beets, tomatoes, batatas, potatoes, and carrots) and their roots (potatoes and batatas) when grown in a closed environment. Each species had its own characteristic composition of volatile discharges. Tomatoes exhibited the maximum number of peaks (14) and potatoes and batatas, the minimum number (17). Nine substances were identified. Common components on all the chromatograms were acetaldehyde, acetone, propionic aldehyde, methanol, and ethanol. Roots released relatively greater amounts of acetaldehyde, propionic aldehyde, and propanol than leaves. On the whole, however, emanation was greater in the case of leaves.

2301 APTIC NUMBER 21625

Deutschen Verein von Gas- und Wasserfachmaennern, Emissionsausschuss
RESTRICTION OF SULFUR-DIOXIDE EMISSION CRACKING PLANTS FOR CITY-GAS PRODUCTION COKING PLANTS AND GASWORKS. (Auswurfbegrenzung von Schwefeldioxid Spaltanlagen zur Stadtgaserzeugung Kokereien und Gaswerke). VDI (Ver. Deut. Ingr.) Richtlinien, no. 2291, Dec. 1966. 3 refs. Translated from German by D. Ben Yaakov, Israel Program for Scientific Translations, Jerusalem, 5p.
CFSTI: TT 68-50469/11

The three processes for producing city gas from mineral oil products (continuous catalytic cracking, intermittent catalytic cracking, and intermittent thermal cracking) are described. Depending on their type and origin, the fuels used contain varying amounts of chemically bonded sulfur. In the combustion of the gases, tars, and mineral oils, sulfur dioxide is formed from the sulfur compounds and reaches the atmosphere through the stack together with the flue gases of the cracking plant. The emission of SO_2 is governed by the quantity of fuel oil combusted and its sulfur content, as well as by the deposits (oil coke and soot). Reference data are given for gaseous and liquid fuels and on SO_2 emission per 1000 cu m STP of produced city gas for different cracking processes and fuels. Hardly any SO_2 is emitted when liquid gas is used; however, liquid gas is only available in limited quantities for producing city gas. At present, a reduction of SO_2 emission is not technologically possible as long as sulfur content of the input product cannot be reduced; thus, cracking-plant stacks must be relied on to reduce the SO_2 concentration near the ground by the greates possible dispersion of SO_2 emission. Stack height regulations must be followed, and permissible SO_2 emission levels considered when planning a cracking plant and selecting the input fuel.

2302 APTIC NUMBER 20498

Diamond, Philip and Hamilton M. Johnson
AIR POLLUTION EVALUATION OF TITAN II TEST FIRINGS. Am. Ind. Hyg. Assoc. J., 26(4):419-422, July-Aug. 1965. 5 refs.

Studies were performed to identify and quantitate the combustion products present in substantial concentrations resulting from the test firing of Titan II missile engines, in order to determine the downwind hazard to personnel from exhaust gases.

Seventeen firings were sampled to obtain the average concentrations of hydrazine and 1,1-dimethylhydrazine (the two components of the fuel used in the missiles), nitrogen dioxide, carbon dioxide, formaldehyde, and cyanide present during first-stage firings. Standard air sampling techniques were used and infrared gas chromatographic and wet chemical analyses were made from a mobile test laboratory immediately after field collection. Air samples taken at 300 and 700 feet from the test stand did not indicate any personnel hazard; despite occasional 450-ppm concentrations at the 300-ft radius, this area is never occupied during a firing. The low-level short-term concentrations of NO2 at the 700-ft radius were well within previously-established safety limits for human exposure. The possible effect of the large quantities of water used as a coolant during test firings on changing or stopping many chemical reactions is not known. Water, soil, and vegetation studies were also conducted; all showed a low level of contamination.

2303 APTIC NUMBER 20698

Dickinson, P.
MEASUREMENTS OF DOMESTIC SMOKE EMISSION AND THEIR APPLICATION TO CLEAN AIR LEGISLATION. J. Inst. Fuel, vol. 43:75-81, March 1970. 15 refs.

To assist in the implementation of a clean air policy, a laboratory investigation was conducted to determine the weight of smoke emitted from domestic solid fuels and appliances. A small electrostatic precipitator was used to determine the weight. A representative range of open-fire fuels including bituminous coals, low volatile steam coals, anthracite, manufactured fuels, and wood and peat fuels were compared by a standard series of tests. Supplementary investigations were made to find the effects of the method of ignition, size grading, and refuelling procedure. Measurements were also made of the emissions from two authorized fuels on a small boiler and from a limited number of experimental smoke-reducing appliances. These investigations have enabled the British Standards Institution to draw up a standard for the authorization of manufactured smokeless fuels and to recommend the exemption of smoke-reducing appliances and to recommend these to the Ministry of Housing and Local Government. It was recommended that the authorization level should ensure a smoke reduction of 80% compared with bituminous coal; a limiting level of 0.9% at a burning rate of 2 lb/hr was considered appropriate.

2304 APTIC NUMBER 20406

Dickinson, Gary W., Howard M. Ildvad, and Raymond J. Bergin
TUNE-UP INSPECTION A CONTINUING EMISSION CONTROL. Preprint, Society of Automotive Engineers, Inc., New York, 23p., 1969. 12 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690141.)

Exhaust emission tests conducted on 478 cars in Los Angeles during the summer of 1968 showed average emission levels in the field to be 675 ppm hydrocarbon and 2.73% carbon monoxide. Thirty of the vehicles were 1966-1968 models equipped with emission control systems. The average uncontrolled vehicle was idling richer than its 'lean best idle' and 64 rpm above specification when obtained for test. The average controlled car idle was also rich, but at 21 rpm below specification. Average sample ignition timing was at specification for both groups. A simple adjustment of idle mixture and idle speed resulted in a significant improvement in exhaust emission level; hydrocarbon emission was reduced by 10% and carbon monoxide emission was reduced by 16%. Customer acceptance of this adjustment was quite high at 93%. The effectiveness of an annual adjustment program, if applied to the passenger car and light-duty truck population of Los Angeles County, would result in reducing the daily output of hydrocarbons by 100 tons and reducing the daily output of carbon monoxide by 1050 tons. This, in effect, would advance the present automotive pollution control program in California by 2 to 5 years. Considering the small annual cost per car, less than $3.00, and the large reduction in emissions, by 10% for hydrocarbons and by 16% for carbon monoxide, this same minor adjustment is ideal for statewide programs of emission control. Such a program would not require special facilities or personnel, would treat all customers equally, and would be more effective in controlling emissions from all cars on the road than any other known field inspection-maintenance approach.

2305 APTIC NUMBER 21234

Diehl, Erle K.
REDUCTION OF EMISSION OF OXIDES OF NITROGEN--PRESENT AND FUTURE PROSPECTS. Preprint, Public Health Service, Washington, D. C., Div. of Air Pollution, 4p., 1966. (Presented at the Conference on Air Pollution, National, Washington, D. C., Dec. 12-14, 1966, Paper B-11.)

Oxides of nitrogen are among the gaseous components emitted from heat and power generation equipment and should not be ignored in the overall evaluation of air pollution. Any process which produces high temperatures in the presence of atmospheric nitrogen and oxygen will yield oxides of nitrogen as a combustion product. Nitrogen oxide (NO) and nitrogen dioxide are of significance in photochemical smog. Emissions of NO from combustion stacks can range from less than 100 ppm to over 1500 ppm. A method of operation known as staged combustion results in a reduction of NO of up to 40%. Current methods under investigation for the removal of other contaminants may also have a marked effect on oxides of nitrogen. Acceptable ground level concentrations of nitrogen oxides must be established before application of known chemistry to the problem will proceed.

2306 APTIC NUMBER 21239

Dikun, P. P. and I. I. Nikberg
INVESTIGATION OF ATMOSPHERIC POLLUTION WITH 3:4-BENZPYRENE IN THE VICINITY OF PITCH-COKE OVENS OF OBSOLETE PATTERN. Probl. Oncol. (USSR) (English Translation from Russian of: Vopr. Onkol.), 4(6): 32-38, June 1958. 6 refs.

The results of an analysis of three sets of samples taken from the vicinity of an obsolete pitch-coke oven, at various times, at various distances from the works, and at points lying at various

directions away from it are given. The first series were of deposits of dusts; the second series were of sedimentation samples; and the third series were of aspiration samples. The analysis of all three samples showed that exceptionally large amounts of carcinogenic hydrocarbons, in particular 3,4-benzpyrene, escaped into the surrounding area. Subsequently, on special government instructions aimed at ensuring a healthy atmosphere, the coke ovens were equipped with special devices to provide additional combustion of exhaust gases. Analysis showed that after reconstruction of the coke ovens, atmospheric pollution in the vicinity of the pitch-coke works sharply diminished.

2307 APTIC NUMBER 21088

Dubrovina, Z. V., S. P. Nikolaev, and N. N. Tomson
EFFECT OF DISCHARGES OF A CEMENT PLANT ON THE POPULATION'S HEALTH. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:110-115, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

Air samples were collected within the range of a cement plant's stack plumes for gravimetric, count, and dispersion determinations. The intensity of atmospheric air pollution with cement dust in the vicinity of the cement plant exceed the dust intensity found in the inhabited region; it was 3-4 times as great as the limit of allowable dust concentration in atmospheric air. Atmospheric air pollution with the cement plant discharges was detected 2000 m from the plant. The results showed that between 41 and 45% of the inhaled cement dust was deposited in the respiratory organs, the amount increasing with the increase in dust intensity. Dust dispersion studies showed that 95% of the cement dust in the air consisted of particles 5 micron in diameter. Particles of this size easily penetrate into the respiratory organs of man. Medical examinations of workers in the cement plant showed an increased frequency in the following morbid conditions: bronchitis, gastritis, gastric and duodenal ulcers, and diseases of the skin and hypodermis. The appearance of a vascular reaction began with the inhalation of 0.5-1.0 mg/cu m of cement dust concentrations. It was concluded that elimination or abatement of cement plant discharges into the atmosphere on inhabited localities can be attained by moving city plants into regions outside the city limits. It can also be controlled by adopting sanitary-hygienic protective means such as complete hermetization of all cement producing processes, installing effective dust catching equipment at all points of dust generation and insuring their proper operation, replacing coal burning with gas burning operations, and increasing the number and extent of park spaces containing trees, shrubs, and other plant life.

2308 APTIC NUMBER 20514

Durocher, Norman L.
PRELIMINARY AIR POLLUTION SURVEY OF BORON AND ITS COMPOUNDS. A LITERATURE REVIEW. Litton Systems, Inc., Silver Spring, Md., Environmental Systems Div., Contract PH 22-68-25, NAPCA Pub. APTD 69-31, 46p., Oct. 1969. 33 refs.
CFSTI: PB 188085

Boron hydrides are the most significant boron compounds related to air pollution. Boric Acid, sodium borates, and boron oxide possess a moderate degree of toxicity. Experiments with the boranes on animals resulted in death preceded by listlessness, incoordination, tremors, convulsions, and coma. Inhalation of highly concentrated diborane produced death in hamsters within 25 minutes. Borane fuel (0.2 ml) administered to the eyes produced severe eye irritation. Boron can be used as an effective herbicide. The TLV (Threshold Limit Values) issued by the American Conference of Governmental Industrial Hygienists are as follows: for diborane, 0.100 ppm; for pentaborane, 0.005 ppm; and for decaborane, 0.050 ppm. An emergency exposure limit for pentaborane of 25 ppm for not over 5 min has been recommended. The use of boron as an additive in petroleum fuels, and as a source of high-energy fuel, its presence in coals, and the manufacturing processes employed in producing boron compounds are believed to be limited sources of atmospheric boron. Neither quantitative nor qualitative data have been found in the literature on the concentration, distribution, or variation of boron or boron compounds in the atmosphere. There is little evidence that action is being taken to reduce air pollution by boron, except in the areas involving use of high-energy fuels. Methods of analysis are available but they are not sufficiently sensitive or selective for determining atmospheric concentrations of boron and its compounds.

2309 APTIC NUMBER 20587

Durocher, Norman L.
PRELIMINARY AIR POLLUTION SURVEY OF BERYLLIUM AND ITS COMPOUNDS: A LITERATURE REVIEW. Litton Systems, Inc., Silver Spring, Md., Environmental Systems Div., Contract PH 22-68-25, NAPCA Pub. APTD 69-29, 79p., Oct. 1969. 71 refs.
CFSTI: PB 188078

Beryllium is among the most hazardous and toxic of the nonradioactive substances being used in industry. Soluble beryllium compounds, such as beryllium sulfate and beryllium chloride, commonly produce acute pneumonitis; insoluble compounds, such as metallic beryllium and beryllium oxide, produce chronic pulmonary disease (berylliosis). However, the toxic effect of beryllium is not limited to pulmonary damage; it can cause body-wide systemic disease. Some beryllium in soils is toxic to plant life. No evidence is available of the effects of atmospheric beryllium on plants or materials. The increased use of beryllium in the metallurgical industry, along with its proposed use as a high-energy fuel for rocket motors, suggests that a study be made of the air pollution aspects of the material. Limited data on environmental air concentrations indicate that daily average values are less than 0.0005 micrograms/cu m, with maximum values of 0.008 micrograms/cu m. Concentrations in the vicinity of a large beryllium plant can range from 0.0281 micrograms/cu m to 0.0827 micrograms/cu m. Both in-plant and out-of-plant emissions are effectively reduced by conventional air-cleaning devices. A list of these devices and their expected efficiency is included. Current control practices limit worker exposure to beryllium dust to about 2 micrograms/cu m or less. The costs of beryllium air-

pollution abatement can exceed $13,000 per year; but, in many instances, the cost is offset by the recovery of valuable materials.

2310 APTIC NUMBER 21318

Ebert, Konrad
THE FUTURE ROLE OF COAL IN THE NATIONAL AND INTERNATIONAL ECONOMY. (Die zukuenftige Rolle der Kohle in der nationalen und internationalen Wirtschaft). Text in German. Glueckauf (Essen), 106(7):337-346, April 2, 1970. 26 refs.

Statistic data indicate that the consumption of coal for power product will be the same in 1980 as it was in 1967. Mineral oil and natural gas will be used for covering the increasing energy demand. Coal consumption will be further on the increase in Eastern Europe while it will markedly go down in Western Europe. In Poland, soft coal mining rose from 9.3 million tons in 1960 to 24.5 million tons in 1968. In 1985, it will amount to 33.3 million tons. Of the 128.6 million tons of hard coal mined in 1968, about 26 million tons were exported. Power plants are Polands major consumer of coal, followed by remote heating plants. The same is true for the Soviet Union. In 1967, 39.3%, of the power was produced with coal; 37.8% with mineral oil; and 17.2%, with natural gas. In Czechoslovakia, 84% of the power is produced with coal. This high percentage will go down to 75.8% in 1970, and 61.2% in 1980 because mineral oil and natural gas from the Soviet Union will be imported for the balance of the total fuel consumption. In France, coal consumption will go down. In Italy, more fuel oil will be used than coal. In all other West European countries, a similar trend can be observed. This is mainly due to the high cost of coal as compared to the lower-priced mineral oil.

2311 APTIC NUMBER 21351

Eisenbud, Merril and Henry G. Petrow
RADIOACTIVITY IN THE ATMOSPHERIC EFFLUENTS OF POWER PLANTS THAT USE FOSSIL FUELS. Science, 144(3616):288-289, April 17, 1964. 6 refs.

Analysis of the fly ash produced by combustion of pulverized Appalachian coal shows that a 1000-megawatt coal-burning power plant will discharge into the atmosphere from about 28 millicuries to nearly 1 curie per year of radium-226 and radium-228. An oil-burning plant of similar size will discharge about 0.5 millicurie of radium per year. Comparison of these data with data on the release of fission products from nuclear-powered generating stations shows that when the physical and biological properties of the various radionuclides are taken into consideration, the conventional fossil-fueled plants discharge relatively greater quantities of radioactive materials into the atmosphere than nuclear-powered plants of comparable size.

2312 APTIC NUMBER 20906

Essenhigh, R. H.
INCINERATION -- A PRACTICAL AND SCIENTIFIC APPROACH. Environ. Sci. Technol. 2(7):524-534, July 1968. 19 refs.

A progress report is given of the following projects undertaken at Pennsylvania State University concerned with the basic science and technology of incinerators: 1) study of the kinetics of typical waste materials during the combustion reaction; 2) combustion study of burning bed behavior in a small combustion pot; 3) cold-model studies of the aerodynamic patterns in an incinerator: and 4) construction and instrumentation of a small test incinerator. The types of waste are classified on a six-point scale. An analysis of the types burned in an incinerator indicates that although the ratio of garbage to rubbish may vary from time to time, the basic combustible ingredients in both cases are carbohydrates, and the principle variation is in water content. For purposes of the study, the area of action in the incinerator is subdivided into two zones: zone one consists of a solid bed and 'underfire', zone two consists of gases and 'overfire'. Of the above mentioned projects, project 1) makes use of paper spheres of varying diameter made from a rapidly mixed pulp of shredded paper and water, which are burned in an airstream at differing flow velocities. Project 2) makes use of steel tubes packed with newspaper rolls or wooden pegs, the principle of which is to form a substantially planar reaction zone at the top of the cylinder and to study this as it moves upstream against the airflow. Project 3) uses a gas tracer (CO_2 or He) to determine the division of the total volume into a stirred section and a plug flow section, with the ultimate object of determining the optimum arrangement for the overfire air to be used in a test incinerator. The test incinerator of project 4) is built of super-duty firebrick, 10 feet high and 2 feet square, equipped with an optical smoke meter and a monitor gas sampling probe, both located in the stack. Plans are to analyze such gases as carbon monoxide, carbon dioxide, oxygen, and water vapor, using a variety of instruments and analyzers.

2313 APTIC NUMBER 21100

Finkelstein, Harold
PRELIMINARY AIR POLLUTION SURVEY OF PESTICIDES. A LITERATURE REVIEW. Litton Systems, Inc., Silver Spring, Md., Environmental Systems Div., Contract PH 22-68-25, NAPCA Pub. APTD 69-44, 169p., Oct. 1969. 115 refs.
CFSTI: PB 188091

The effects, sources, abatement, economics, and methods of analysis of pesticides are reviewed; appendices are provided of tabular material from selected references in additon to a glossary of names and uses of pesticides. The organophosphates are generally the most toxic while the chlorinated hydrocarbons present the greatest residue problem resulting in residue levels of DDT, particularly in human and animal fat tissue, in all parts of the world. At present, there is no medical evidence that the storage levels found in humans can produce chronic adverse health effects. Agriculture uses the most pesticides in the country, and the primary atmospheric contamination results from drift during the application process. Pesticides can volatilize into the air from soil, water, and treated surfaces, and pesticides

containing dust from the soil can enter the ambient air and be transported for considerable distances before falling back to earth. Pesticides have been detected in the ambient air of the locales where they are used, as well as in urban and rural areas. Control methods used by the chemical industry in general are used in pesticide production facilities, while methods are under development to control pesticide drift during application, including use of micrometeorological data. In recent years, significant advances have been made in instrumentation for detection and analysis of low concentrations, usually by some form of chromatography. (Author abstract modified)

2314 APTIC NUMBER 20592

Finlayson, J. Bruce, I. Lynus Barnes, and John J. Naughton
DEVELOPMENTS IN VOLCANIC GAS RESEARCH IN HAWAII. Geophys. Monograph, no. 12:428-438, 1968. 12 refs.
CSFTI: N69-38888

Gases were collected from the Makaopuhi lava lake during the eruptions of 1964-66 and analyzed by a variety of techniques; changes in gaseous composition during the cooling and solidification were followed. Samples were taken from the surface and holes through its solid crust by an evacuated double-walled silica tube, with silica filling in the evacuated space, and which was sealed with an oxygen-gas torch immediately on withdrawal. Parts of the collections were analyzed by gas chromatography and mass spectrometry, while other tubes were used as liquid chromatographic columns, eluted, and subjected to qualitative and quantitative tests by wet-chemical techniques, X-ray diffraction and fluorescence, and infrared spectrophotometry. Oxygen and the accompanying nitrogen from air always were found as measurable components; corrections had to be made for air contamination. On isotopic analyses from a source vent, argon was released with the first gases. Gaseous composition was characteristically variable with position on the lava lake at a given time, within a given drill hole with depth of collection, and with time since eruption. A progressive depletion of carbon and sulfur gases with time was noted and associated with the relative solubilities of the gaseous components in the rock melt. Collections made from lava flows covering vegetation always showed a large content of methane, which was predominant in the early phase of cooling of the flow. It appears that somewhat different situation exists in comparing gas from the lava lake with that from the primary volcanic vent; in either system, water is probably the most soluble of the major gases in magma at high temperatures and at both high and low pressures.

2315 APTIC NUMBER 21022

TRACE 60 PER CENT OF AIR POLLUTION IN U. S. TO RECIPROCATING ENGINES. Gas Turbine Int., 11(2):38-41, March-April 1970.

The low contribution of the motor vehicle to sulfur dioxide emissions is due to the fact that the gasoline fuel used has a very low sulfur content; but the reciprocating internal combustion engine as now used accounts for more than 65,000,000 tons of carbon monoxide, 11,000,000 tons of hydrocarbons, and significant nitrogen oxides and particulate matter. On a road test, using white gasoline as fuel, the ratio of turbine emission to reciprocating engine emissions were hydrocarbon, 0.243; carbon monoxide, 0.06; carbon dioxide, 2.30; and nitrogen oxide, 0.84. Carbon monoxide emission of the spark ignition engine at 30 mph vehicle speed is about 45 times greater than that for a regenerative gas turbine, and carbon monoxide produced by the medium-range turbofan jet engine in aircraft is only 0.12 that in the average automobile without emission control.

2316 APTIC NUMBER 21132

Gradt, E. W.
STEEL FOR LNG STORAGE TANKS? Gas Age, vol. 133:28-32, July 1966.

The use of 9-percent nickel steel as a safe, economical material for the main units of large, flat-bottom, liquefied natural gas above-ground storage tanks is described; the material has strength, ductility, and high notch toughness at temperatures down to -320 F. Experience to date shows these tanks effective in sizes up to about 175,000 bbl; large tanks can be built, but the upper economic size limit has not yet been defined. The advantages of double-wall steel tanks are outlined, including the following: 9-percent nickel steel has been extensively tested and has proved itself in other cryogenic application; boil-off losses are effectively reduced; and a steel-tank storage system will not contaminate the LNG. Several existing LNG steel storage plants are described, and a comparative cost summary is given evaluating various facilities as sources for peak shaving gas. Nine-percent nickel steel has also been used as the dome material in the first U. S. commercial 'frozen hole' in-ground cryogenic storage facility in New Jersey.

2317 APTIC NUMBER 21105

Guilhem, M. and L. L. Richard
CONCEPT OF MODEL-TESTING OF GAZ TRANSPORT/GAZ DE FRANCE MEMBRANE TANK FOR METHANE TANKERS. Text in French. Institute of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 17p. (April 7-12, Session No. 6, Paper 34.)

The design and testing of the membrane concept as applied to cargo tanks is described. The primary liquid containment barrier is Invar and is attached to insulation boxes made of plywood. The insulating material is expanded perlite. Static and dynamic forces are transmitted through the insulation to the inner hull of the ship. An extensive test program was undertaken on each component of the system, and prototype cargo tanks were used to simulate the static and dynamic forces which would be experienced at sea. The U. S. Coast Guard Administration has approved the concept and design. At present, two membrane LNG tankers, each with a capacity of 450,000 barrels, are being constructed to transport gas from Alaska to Japan. (Author abstract modified)

2318 APTIC NUMBER 21148

Hanke, C. C. and H. T. Marshall
DESIGN AND CONSTRUCTION OF THE BOSTON GAS COMPANY LNG FACILITY. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 15p. 1 ref. (April 7-12, Paper 2-5).

Unusual features of a newly-built liquefied natural gas plant in the Boston area are described. It will have the largest 'Expander' cycle natural gas liquefaction system in the LNG industry. A duel-expander liquefaction cycle in which two expanders will be operated in parallel will provide a better range of control and turndown capacity, as well as greater operating efficiency. The liquefaction rate will therefore be one of the highest in comparison to initial storage capacity for a peak shaving facility. The plant will have the largest LNG molecular sieve treatment facility, with a unique five-bed system for removal of CO2 and water prior to liquefaction. The double-wall, above-ground storage tank has a capacity of one billion cu ft, with suspended insulating deck over the inner shell. It is not gas tight and serves as a thermal barrier permitting methane boil-off to permeate the insulated area between the shells. A 1.5 psig internal pressure design double wall tank will permit operating on absolute pressure control, thus eliminating difficulties that other peak shaving plants have with 0.5 psig storage systems. Stringent safety considerations are an important factor in plant design. The liquefaction, storage, and send-out systems are described and illustrated in some detail.

2319 APTIC NUMBER 21485

Haselbarth, J. E. and J. M. Berk
CHEMICAL PLANT COST BREAKDOWN. NEW RATIOS SHOW WHERE DOLLARS GO. Chem. Eng., vol. 67:158, May 16, 1960. 5 refs.

Cost data are presented tabularly for several categories of chemical plants. Table I shows separate cost distribution in small and large installations for solids processing, solid-fluid processing, and fluid processing. Cost breakdown is expressed as a percent of total plant investment based on investigations of some 70 plants in the Gulf Coast area and on published data. Table II gives replacement cost data as a percent of total plant cost for nine large fluid process plants also in the Gulf Coast area.

2320 APTIC NUMBER 21385

Hendrickson, E. R., J. E. Roberson, and J. B. Koogler
CONTROL OF ATMOSPHERIC EMISSIONS IN THE WOOD PULPING INDUSTRY. (VOLUME 1). (FINAL REPORT). Environmental Engineering, Inc., Gainesville, Fla. and Sirrine (J. E.) Co., Greenville, S. C., NAPCA Contract CPA 22-69-18, 193p., March 15, 1970. 35 refs.
CFSTI: PB 190351

A study was conducted to make a comprehensive and systematic evaluation of the technical and economical problems involved in the control of airborne emissions, especially particulate and gaseous sulfur compounds from the chemical wood pulping industry. The economic position and present geographic distribution of the chemical wood pulping industry are discussed. The major variations in the kraft, sulfite, and semichemical pulping processes are described. Kraft gaseous emissions include hydrogen sulfide, sulfur dioxide, methyl mercaptan, and dimethyl sulfide. They are emitted by the recovery furnace, the lime kiln, evaporators, stock washers, smelt dissolving tank, and other sources. Particulate emissions from the kraft process come mainly from the recovery furnace, the lime kiln, and the smelt dissolving tank. Emissions from the sulfite and semichemical processes are also discribed, along with a review of emissions standards.

2321 APTIC NUMBER 20646

Hirayama, Naomichi, Kazuo Nishida, Sadao Konno, and Toshio Ohira
A RESEARCH ON THE REFUSE INCINERATORS FROM THE VIEWPOINT OF SMOKE PROPERTIES. Bull. JSME (Japan Soc. Mech. Engrs.), 11(47):902-912, 1968. 4 refs.

Operating conditions, type of refuse burned, concentrations of noxious flue gas components, and the amount of dust and fly ash in flue gases were determined for 15 municipal and private incinerators in Tokyo. Integrated test results are tabulated and evaluated in terms of incinerator design criteria. Concentrations of hydgrogen chloride were high where rubbish was burned, sometimes reaching 2000 ppm in emissions from department store incinerators. This amount renders furnace design almost impossible due to the metal corrosion. The concentration of HCl in the flue gas of municipal incinerators is usually less than 200 ppm, so attention should be paid to high temperature incineration and stress corrosion of metals. The total of sulfur oxides in flue gas from incinerators is less than 100 ppm. Ammonium is not produced by rubbish combustion, and that produced by garbage combustion can be substantially reduced by high-temperature incineration, as can concentrations of aldehydes. Temperature has no effect on organic acids, the total content of which is usually less than 100 ppm, but high temperatures (above 900 C) produce increased concentrations of nitrogen dioxides. The dust and fly ash content in the flue gas of continuous combustion incinerators are nearly equal to that of the batch combustion type. The ash content can be controlled by retaining the ash on the afterburning grate for a sufficient period of time. With respect to dust, dry collectors are perferable for refuse incinerators.

2322 APTIC NUMBER 21020

Ikegaya, H.
ON THE AIR POLLUTION BY FERRO ALLOY OPEN ELECTRIC FURNACE. (Gokintetsuyo kaihogata denkiro no taiki osen ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):79, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The exhaust gas which consists mainly of metal fumes emitted in the process of iron alloy manufacturing contains dust particles, the average concentration of which ranges from 1.3 to 4.7 grams per 1000 cu. m. Iron alloy industries used to be located in areas with low electricity cost, but with the recent reductions in the cost differentials, they are found all over Japan; their air pollution is quite complex, depending on the local geography. The number of electric furnaces in the country number several hundred, of which only about ten possess control devices measuring up to the Air Pollution Control Standard. The dusts fall in two categories: F-Si, F-Ca.Si,F-Si.Mn; and F-Mn. The first range from 0.6 to 0.8 micron in size, and possess high electrostatic resistance, adhesiveness, and diffusion rate; they are only subject to collection by a dry-type filter yet to be fully developed for that purpose. The second type with much coarser grains can be captured by wet-type collectors.

2323 APTIC NUMBER 21108

Jones, H. J. and W. J. Walters
FACILITIES FOR THE RECEPTION OF L.N.G. IN THE UNITED KINGDOM. Centre International de Documentation et d'Etudes Petroliers, Monte Carlo, Monaco, Proc. Congr. Intern. 1st, Petrole Mer, Monte Carlo, Monaco, 1965, p. 306(1)-306(5). (May 12-20, Paper 306.)

The general requirements of a liquefied natural gas reception terminal are discussed, and the various facilities of the British terminal at Canvey Island for receiving LNG from Algeria are described and illustrated, including jetty facilities, storage tanks, liquid methane pumps and evaporators, and pipeline control. LNG will arrive at the terminal which began operation in 1964, at a rate of 12,000 tons about every six days at full load operation. The five 4000-ton storage tanks and two 1000-ton prototype tanks provide a total capacity of 22,000 tons and consist basically of two concentric tanks with the interspace filled with insulating material. Pumps and evaporators were designed to deliver gas at the maximum working pressure of 1000 psig. The jetty at the terminal can accommodate ships of up to 60,000 tons dead weight. A comprehensive communications and control system was installed on the pipeline to monitor distribution to the eight regional gas boards that receive most of the gas. The importance of integrating LNG reception facilities with the requirements of preceding and succeeding stages in the operation is stressed.

2324 APTIC NUMBER 21118

Jungell, Hans A.
A NEW METHOD FOR STORING LIQUEFIED GASES. (Ein neues Verfahren zur Speicherung von verfluessigten Gasen). Text in German. Erdoel Kohle (Hamburg) 13(12):997-1000, Dec. 1962. (Presented at the annual meeting of the German Association for Mineral Oil Science and Coal Chemistry, Karlsruhe, Oct. 12, 1962.)

Gases which are liquefied at sub-zero temperatures such as oxygen, nitrogen, and methane can be safely stored in the ground in an excavated earthen cavity which is covered by a gas tight insulated roof. The cold liquid gas filled into the cavity freezes the water in the surrounding soil, thus rendering the cavity liquid and gas tight without special lining or insulation. During the storage period, the isotherms of frozen ground move gradually outward until an equilibrium is reached with heat flow from the surrounding soil. Small quantities of evaporated liquid are continually drawn off. If the ground water level is high at the storage site, pre-freezing the soil around the cavity is necessary. No problems were encountered in large-scale experiments near Lake Charles in Louisiana with liquefied natural gas of -165.5 C, despite extremely difficult conditions. The cavity was 6 m deep and had a diameter of 6 m. The soil was composed of sand and clay. The groundwater level was just 60 cm below the surface. The soil was pre-frozen. Swelling the soil by 15 cm caused no problems, since the roof was attached afterwards. Underground storage of liquefied gas is less hazardous because there is no danger of a break. In case of fire, it will burn like a flare and can be fought from close-by. It is easier to maintain a sub-explosion methane level than gasoline level, since the concentration of the former in air has to be four times as high as gasoline to reach the explosive level. The ignition temperature is twice as high for methane as for gasoline.

2325 APTIC NUMBER 21363

Kawai, Sunao, Tadahiro Machiyama, and Mutsuo Koizumi
EXPERIMENTAL STUDIES ON A HOT-WATER BOILER WITH FLUE-GAS RECIRCULATION. Text in Japanese. Waseda Daigaku Rikogaku Kenkyusho Hokoku (Bull. Sci. Eng. Res. Lab., Waseda, Univ.), no. 41:38-45, 1968. 3 refs.

Experimental studies were conducted on the applications of a pre-combustion method with flue-gas recirculation to the reheating furnace. The furnace is thermally loaded by a hot-water boiler which is set up at the end of the furnace. In the experiments, the behavior of the boiler offered some interesting information. Some considerations of the operations from the circuit theoretic viewpoint are reported. The concept of operating point is clarified through the considerations, in spite of the non-linearities which exist in the boiler characteristics. The optimum operating point to maximize the water outlet temperature is found on the basis of the characteristics for values of the fuel and the feed water flow-rate. This fact shows the possibilities in an application of the optimizing control technique to the boiler.

2326 APTIC NUMBER 20644

Kellett, E., J. F. Betteridge, and M. Mistovski
INVESTIGATION OF DIESEL ENGINE AND TURBOCHARGER INTERACTION. Eng. Rev., 7(4):102-113, Dec. 1969. 7 refs.

The future competitive position of the automotive diesel engine will depend on higher thermal efficiencies and higher mean effective pressure with improved air utilization and without increase in piston speed. To determine the effects of turbocharging and fuel injection equipment on engine performance,

over 350 test were conducted on a conventional four-stroke engine over its speed range. The tests demonstrate a tendency toward constant horsepower when output is controlled to simple limits of smoke level, exhaust temperature, and maximum cylinder pressure with a fixed-geometry turbocharging system. Though a constant horsepower of 350 bhp at full speed was achieved by eliminating the high air/fuel ratio due to the use of fixed geometry turbochargers, the exhaust temperature increased by 200 C. The lowest engine speed at which the high output was possible was very critical to the fuel-injection rate; the fall-off in torque below this speed was extremely rapid. Experiments at this condition indicated the importance of optimizing the fuel injection equipment to balance the air and fuel supply. Investigations into combustion behavior at high charge density showed that, for the same air/fuel ratio, smoke levels tend to increase with increasing density. However, the increases in smoke has an insignificant effect on specific fuel consumption. Charge density has little influence on the fuel-air mixing pattern. (Author conclusion modified)

2327 APTIC NUMBER 21107

Khan, A. M. and B. E. Eakin
RECENT DEVELOPMENTS IN L.N.G. STORAGE SYSTEMS. Centre International de Documentation et d'Etude Petrolieres, Monte Carlo, Monaco, Proc. Congr. Intern., 1st, Petrole Mer, Monte Carlo, Monaco, 1965, p. 321(1)-321(6). 6 refs. (May 12-20, Paper 321.)

Present industrial practices for storing cryogenic fluids and existing LNG tankage are reviewed briefly. The development program for a 1000-barrel test tank, and final design of below-ground concrete LNG tanks are described. Results of laboratory tests are given for various tank parts and construction materials. Major economies are being sought by investigation of cheaper liners and insulation techniques. Cavern storage for LNG is also under active development as a result of such efficient mining techniques as inclined entry tunnels. The results of laboratory experiments on the thermodynamic and physical properties of rocks at low temperatures, and calculations of heat influx and thermal stress distribution are presented. Heat influx rates for the caverns indicated that insulation would be required to produce an acceptably low evaporation rate for peakshaving storage (0.1% of total volume per day, or less). The strength of all rock types increased with lower temperatures; granite was the strongest. Water-saturated samples had higher strength than their dry counterparts. The thermal conductivity of limestone, sandstone, and granite increased at lower temperatures; water-saturated sandstone showed the greatest increase and highest values. Design considerations for cavern operation are discussed, and plans for the construction of a pilot cavern are described.

2328 APTIC NUMBER 20590

Kramer, C. L., S. M. Pady, R. Clary, and R. Haard
DIURNAL PERIODICITY IN AECIOSPORE RELEASE OF CERTAIN RUSTS. Trans. Brit. Mycol. Soc., 51(5):679-687, 1968. 9 refs.

Aeciospores of three rust species, Uromyces psoraleae, Puccinia andropogonis, and Phragmidium speciosum were sampled in the vicinity of Manhattan, Kansas during 1964 and 1965. Kramer-Collins spore samplers were used. Samples were taken three times during the hour for a total of 10 min and a total air volume of 8 cu ft/sample. The same leaf was used as long as sporulation continued, so that a continuous record of spore release was obtained. In the aeciodioid rusts, Uromyces psoraleae, and Puccinia andropogonis, the aeciospores are shrunken and angular when dry; as water is taken on, the spore wall instantaneously expands into a spherical shape with a force sufficient to expel the spores free of the constricting peridium. This results in a peak in aeciospore release between 20:00 h and midnight, except when rains cause immediate spore release. In the caeomoid rust, Phragmidium speciosum, aeciospores display the same discharge mechanism; however, since the spores accumulate as an exposed mass on the surface of the pustule, wind apparently also functions in their dispersal, producing both day and night peaks. (Author abstract modified)

2329 APTIC NUMBER 20516

Kramer, C. L. and S. M. Pady
VIABILITY OF AIRBORNE SPORES. Mycologia, 60(2):448-449, March-April 1968. 4 refs.

Spore viability was determined by the ability to form germ tubes for 25 twenty-four hour and 10 forty-eight hour samples taken hourly from the roof of a campus building during the growing seasons of 1959-1962. The average viability of all spores during this period was 40%, and the highest germination was found in Alternaria which had an overall average of 80%, followed by Cercospora 53%, fusoid ascospores 47%, Cladosporium 45%, rust urediospores 32% and basidiospores 6%. There was day to day variation in viability, due possibly to the age of spores, and also evidence of hour to hour variation. The increase in percentage of viable spores following a moist period is probably due to increased spore production and the release of fresh spores into the atmosphere. Alternaria apparently retains its viability for long periods of time, while the thin-walled spores such as basidiospores seem to have a very short life. The viability of hyphal fragments (20%) is further evidence that these are significant components of the airborne fungus flora.

2330 APTIC NUMBER 20489

Kustov, V. V. and L. A. Tiunov
PROBLEMS IN SPACE TOXICOLOGY. Izv. Akad. Nauk SSSR Ser. Biol., 1968:605-608, July-Aug. 1968. 35 refs. Translated from Russian. Joint Publications Research Service, Washington, D. C., 8p., Sept. 11, 1968.
CFSTI: JPRS 46403

Toxicological problems associated with hermatically sealed space cabins are discussed. Particular attention is drawn to plastics as a major source of harmful impurities. For example, when destroyed by heat, polymers containing fluorine and phosphorus release highly toxic compounds that cause serious cases of poisoning. Medical control of the use of polymer materials in

sealed systems is of primary importance. The gaseous composition of air in a closed environment is also markedly affected by products of vital human activity; carbon monoxide is of greatest toxicological importance. Extreme tolerable concentrations (ETC) of impurities must be established that not only guarantee protection against acute or chronic intoxication but provide for the resistance of the body to other space factors. ETC values should be determined from threshold concentrations based on enzymatic indices as well as the integral and specific indices used in industrial toxicology. The values must be experimentally checked on animals and human volunteers.

2331 APTIC NUMBER 20557

CHEMICAL IDENTIFICATION OF THE ODOR COMPONENTS IN DIESEL ENGINE EXHAUST (FINAL REPORT). Little (Arthur D.) Inc., Cambridge, Mass. Contracts PH 22-68-20 and CD-13-68, Proj. CAPE-7, 92p., July 1969. 3 refs.
CFSTI: PB 185878

As part of a total program related to the chemistry of diesel exhaust, odor compounds in diesel exhaust were characterized with respect to their type, intensity, threshold values, character, and possible contribution to human irritation. In addition, techniques were developed for separating the odor components from diesel exhaust. The odor profile of diesel exhaust at a 1/600 dilution in air describes three odor character notes - oily, burnt, and kerosene - and two feeling sensations - nose irritation and eye irritation. These five elements appear to vary in intensity as a function of diesel exhaust level in the test room. The system for separating the components of diesel exhaust uses silica liquid column chromatography followed by silicone and carbowax gas chromatography. Preliminary analysis shows that several individual components with odors relating to the burnt complex are present in sufficient concentration to permit identification, particularly with regard to the low-boiling-temperature fractions. The separation techniques should be sufficient for isolating the odor components related to kerosene and those which are described as oily.

2332 APTIC NUMBER 21286

Marquardt, W., R. Hoehle, and G. Schuh
RADIOACTIVE EMISSION BY COAL-FIRED POWER PLANTS. (Radioaktive Emissionen durch Kohlekraftwerke). Text in German. Z. Hyg., 16(3):188-191, 1970. 12 refs.

The radium emanation of various coal and ash samples was determined. For this purpose, 5 g KOH was put into a nickel container and the water removed by melting over a burner; 5 g ash (with a particle size of less than 0.25 mm) was added to the cold melt. Through repeated heating, a clear melt was obtained which was converted into an alkaline iron hydroxide suspension to which 75 ml concentration HNO3 was added. The acid solution was diluted. The radium content of the various samples thus prepared ranged from 0.6 to 4.7 pCi/g flue ash. These concentrations agree with those stated in the literature. No remarkable difference was found between bituminous coal samples and brown coal samples or between samples with different geological formation. Differences were discernible between samples from geographically different sites. From the quantity of fly ash emitted by coal-fired power plants in the GDR, no inadmissibly high emission values were detected and calculated. The calculations were based on the most unfavorable long-term dispersion factor in the atmosphere as it generally occurs only at a source distance of 1 to 1.5 km. It was assured that the fly ash has the properties of aerosols over its entire grain size distribution and that it may become particularly toxic by readily pentrating into the lungs. The radium concentration caused by coal-fired power stations is at least 2 to 3 potencies below the admissible values for residential areas. Measurements of the ThX emission concentrations in random samples revealed that only 0.1% of the maximum allowable concentration (7 times 10 to the minus twelfth power Ci/cu m) was found in the vicinity of large power plants.

2333 APTIC NUMBER 21707

Martini, H.-J.
FOSSIL FUELS, ORIGIN, OCCURRENCE, MINING AND ECONOMIC IMPORTANCE. (Fossile Brennstoffe, ihre Entstehung, Verbreitung, Gewinnung und wirtschaftliche Bedeutung). Text in German. VDI (Ver. Deut. Ingr.) Ber., no. 149:27-33, 1970.

Swamps cover about 1.8 mill sq. km of the earth's surface, producing 800 million tons of dry plant substance per year. Depending on the climate, 20 to 60% of this plant mass is converted to peat, and it is estimated that about 100 million tons of peat are newly produced each year. Coal forms from peat that has been buried by layers and layers of soil: 10 to 15 cm hard coal are gradually formed from 1 m of peat. Photosynthesis plays an important part in this process, whereas mineral oil and natural gas develop primarily from animal substance. About 97.5% of the earth's immense coal resources are found on the Northern hemisphere. North America, Western Europe, Russia, China, and India have the world's largest coal deposits. The Federal Republic of Germany has 125.8 billion tons of hard coal deposits, and 62 billion tons of soft coal deposits. Man is being replaced by machines in the mines. Coal mining has decreased in 1957-1968 from 19% to 13.4% in the Common Market countries, while mineral oil and natural gas are being increasingly used. The mineral oil consumption amounted to 49% in the FDR in 1968, and the natural gas consumption was 3%. The Middle East has the richest mineral oil and natural gas resources (36.8 million tons of mineral oil, and 6.5 billion cu m natural gas), followed by Russia and her satellites and North America.

2334 APTIC NUMBER 20567

Massey, P. S.
FROZEN EARTH STORAGE: HOW PHILLIPS BUILT IT. Hydrocarbon Process. Petrol. Refiner, 43(3):147-149, March 1964. (Presented to the Natural Gas Processors Association, New Orleans, La., March 11, 1964.)

In 1962, work on a frozen-earth storage facility of 160,000 barrel capacity for propane and similar products was started at Phillips Woods Cross refinery near Salt Lake City, Utah, which was placed in operation storing propane at a temperature of -56 F and a pressure of about 6 in. of water. It consists of an unlined 100 ft diameter 95 ft deep cylindrical pit at the earth's surface within an artificially made frozen-earth enclosure and covered with a heat-insulated gas-tight steel roof. The soil in the site is a water-bearing mixed soil containing alternate layers of fine to coarse sand, gravel with stones up to cobble size, and some sandy clay, underlain by a relatively thick layer of impervious silty clay. Construction began by setting vertical 'freeze pipes' to a depth of 155 ft in a circular configuration averaging about 114 ft in diameter. Each pipe consists of a liquid line inside of a vapor line which is tied to a separate header. Other pipes containing thermocouples were set at various points outside and inside the 'freeze ring'. After a complete frozen-earth ring had formed, excavation was done with a small bulldozer and a clam-shell boom crane. During the excavation period, the pit roof framing was constructed adjacent to the pit and, in the end, lifted into position by boom cranes. A refrigeration system using the stored product as refrigerant serves to condense boil-off vapor from the pit itself and the vapor generated when the incoming stream is flashed to storage temperature. The operating costs and economic merits of this kind of storage facility are discussed.

2335 APTIC NUMBER 20681

Matsuoka, C., T. Kitamura, I. Tahara, H. Kondo, and K. Takeda
A STUDY ON THE MEASUREMENT OF THE FLYING-DUST FROM A CHROMATE FACTORY. (Kuromusanseizokojo kara ao funjin no hisan ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):38, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

In May 1969, some sodium bichromate was accidentally released from the new sodium bichromate pilot factory in Tokushima; some health as well as crop damages were reported. The accident occured during the repair of the wet scrubber that eliminates the exhaust from the dryer. The subsequent public concern over the constant emission, however minute due to the strict control measures installed, eventually led to the establishment of a new temporary emission standard with respect to the valence six chromium in the atmosphere. The extent of the amount released in the atmosphere was estimated at about 2 kg sodium bichromate spreading over the area in the range of 0.2 km at 50 - 150 micrograms per cubic meter. The health damages were mainly headaches and throat irritations with severe fatigue, and most patients recovered within two weeks. The leaves of rice plants showed brown to black spots, and the concentration responsible for the damage was about 0.85 - 72 ppm.

2336 APTIC NUMBER 20884

Mayaudon, Enrique Marquez
PRELIMINARY SURVEY OF AIR AND WATER POLLUTION BY INDUSTRY IN SEVERAL BORDER CITIES OF NORTHERN MEXICO. (Encuesta preliminar sobre contaminacion industrial del aire y agua en algunas ciudades fronterizas del norte de Mexico). Preprint, 11p., June 1967. Translated from Spanish. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 13p., Sept. 17, 1969.

The following nine cities were briefly surveyed in May 1967: Matamoros, Reynosa, and Nuevo Laredo in the state of Tamaulipas; Piedras Negras in Coahuila; Ciudad Juarez in Chihuaha; Nogales in Sonora; and Mexicali, Tecate, and Tijuana in Baja California. The survey was based on the consumption of raw material and output from various emission sources. Air pollution was found to stem mainly from natural sources (pollen, dust, bacteria); emissions from internal combustion engines were the second largest source. Industry in these areas is in beginning stages, with small plants (fewer than 100 workers) predominating; present plants which may eventually contribute to more serious air pollution problems include petroleum installations, a steel smelting plant, metallurgical, insecticide plants, a brewery, and factories which manufacture construction materials. Brief results of the survey are given for each city.

2337 APTIC NUMBER 17576

McKee, Herbert C., John M. Clark, and Ralph J. Wheeler
MEASUREMENT OF DIESEL ENGINE EMISSIONS. Preprint, Air Pollution Control Association, New York City, 7p., 1962. 4 refs. (Presented at the Air Pollution Control Association Annual Meeting, 55th, Chicago, Ill., May 20-24, 1962.)

The emissions of seven different types of diesel engines were measured: experimental four-cycle divided chamber and open chamber engine, with or without turbocharger; one single and one two-cylinder research diesel engine; and a supercharged version of a single cylinder diesel engine. The hydrocarbon content of exhaust and blowby streams was measured by three different methods in order to obtain comparison between them: a non-dispersive infrared gas analyzer with a n-hexane detector; flame ionization analysis detector; and a recording infrared spectrometer and one-meter gas cell. Carbon monoxide and carbon dioxide were measured by the Orsat method, using gas samples collected in evacuated glass bulbs. To obtain some preliminary data on nitrogen oxides, a limited number of grab samples were collected, using evacuated glass bulbs. These were analyzed by the phenoldisulfonic acid method. The hydrocarbon content in diesel engine exhaust and blowby was low compared to that from conventional automobile engines. The values for ethylene and acetylene indicate that the light hydrocarbon gases may constitute a larger proportion of the total hydrocarbon constituents than with automobile exhaust. The flame ionization detector gave the best results, both because it measured total hydrocarbon content and because the instrument was better suited to continuous operation at the low concentrations encountered. The non-dispersive infrared instrument lacked sensitivity. With all methods, condensation of hydrocarbons in the sampling system may represent a substantial source of error in measuring diesel exhaust emissions.

2338 APTIC NUMBER 20545

Megonnell, William H.
THE AUTOMOBILE AND THE ATMOSPHERE. Preprint, Missouri Univ., Columbia and Missouri Air Conservation Commission, Jefferson City, 11p., 1969. (Presented at the Conference on Air Pollution, Columbia, Mo., Nov. 18, 1969.)

The automobile has become one of the major sources of air pollution in the U. S. Today, approximately 90 million automobiles are producing smog in every major urban area in the country, and this is only of the automobile products that threaten the environment. The automobile is responsible for 75% of the carbon monoxide discharged to the air each year. It is responsible for more than 50% of the hydrocarbon emissions, 50% of the nitrogen oxides, and it is the chief source of lead. The Federal emission standards, which apply nationwide will significantly reduce the amount of pollutants discharged from the automobile. It is believed, however, that even with the more stringent standards contemplated for 1973, CO levels are not going to be reduced sufficiently in the cities to protect human health. These standards will prolong the downward curve in vehicle emissions until the early 1980's, when the level will again rise. It is recommended that the amount of tetraethyl lead in gasoline be reduced to the absolute minimum necessary to accomplish its function. There is also the problem of the basic components of the fuel itself, which affect such things as fuel volatility, reactivity, and other characteristics which have a bearing on pollution emission. Modifying the internal combustion engine may solve these problems. The final solution, the development of a relatively pollution-free vehicle, is left up to the automobile manufacturers and the petroleum industry.

2339 APTIC NUMBER 21302

Michel, Bernhard
FACTORS AFFECTING THE CHARACTERISTICS OF OIL FLAMES. (Einfluesse auf die Ausbildung von Oelflammen). Text in German.
Brenstoff-Waerme-Kraft, 22(3):108-114, March 1970. 30 refs.

The various factors affecting the characteristics of oil flames are divided into four groups: effects of fuel, of combustion air, of combustion chamber, and of the burner. The heat radiation is decisively influenced by the C/H ratio of the fuel because soot formation depends on it. To increase heat radiation, the soot content must be artificially increased by adding pulverized coal to the flame. These soot particles have a longer life span in the flame than those formed from oil. Inside and outside mixing type of burners were compared in IJmuiden as to their effect on the flame. Spray type and vapor type burners yielded a long narrow flame; the mechanical and rotary type burner yields a short, bushy flame. The method of adding combustion air is of great importance. If a rotating force is imparted on the combustion air, a pressure drop near the axis and a pressure increase at the jet boundary can be observed. If no rotary movement is imparted, the temperature rises later. Enrichment of combustion air with oxygen reduces the unwanted nitrogen entrainment, and the combustion speeds increased. The wall may cool the flame so that the temperature increase is delayed, and more soot is developed. Too intense cooling may leave too many unburned hydrocarbons. The tests in IJmuiden showed that conically expanding burner nozzles are of advantage. Comparison of five oil burners of different design showed that the construction of the burner has no significant influence as long as the jet momentum is the same.

2340 APTIC NUMBER 21149

Miller, R. T.
CONSTRUCTION AND OPERATING PLANT EXPERIENCE. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 17p. 5 refs. (April 7-12, Paper 2-9).

Economic and technical aspects of a new liquefied natural gas plant in the northwest U. S. are discussed. Cost comparisons demonstrating that LNG can compete successfully with liquefied petroleum gas. The basic design of the plant centers on the use of high pressure gas received from the pipeline and an expansion cycle in which about 90% of the feed stream is returned to the distribution system, with the balance sent to liquid storage. A flow diagram is given, and the design parameters which are reviewed include feed gas, interchangeability, pre-treatment of feed gas, storage capacity (175,000 barrels), re-vaporization, instrumentation and control. The liquefaction system can be operated for normal liquefaction, boil-off make-up, and a 'holding only' mode. The maximum net liquefaction rate provided by a two-stage, high-speed, turbo-expander is about 2.89 MMCF per day. Water vapor and sulfur are removed from the feed stream, and CO2 from the liquefaction stream, by adsorption in 'Drier' beds of molecular sieve material. Electronic control systems, telemetering instrumentation, and unattended operation from the dispatch center seven miles from the plant are described.

2341 APTIC NUMBER 21635

Moore, George Evan and Morris Katz
POLYNUCLEAR AROMATIC HYDROCARBONS IN THE PARTICULATES OF DIESEL EXHAUSTS IN RAILWAY TUNNELS AND IN THE PARTICULATES OF AN URBAN ATMOSPHERE. Intern. J. Air Pollution, 2(3):221-235, March 1960. 14 refs. (Presented at the American Chemical Society, Air Pollution Symposium, 136th National Meeting, Atlantic City, N. J. Sept. 1959.)

The identification of polynuclear aromatic hydrocarbons in the particulate matter arising from the operation of heavy diesel locomotives in railway tunnels is described. Results are compared with those derived from a similar analysis of particulates collected from an urban atmosphere. Although diesel operation in the tunnels increased the particulate loading to eight times normal, the detectable amounts of polynuclear aromatic hydrocarbons were such as might be found from the particulates carried into the tunnel by ventilating air. Chromatographic and spectrophotometric methods were used. Production of polynuclear aromatic hydrocarbons be efficiently operated diesel locomotives is negligible in comparison with the formation of this group by general combustion of fuels in urban activities. (Author abstract modified)

2342 APTIC NUMBER 20927

Northern Research and Engineering Corp., Cambridge, Mass.
NATURE AND CONTROL OF AIRCRAFT ENGINE EXHAUST EMISSIONS. NAPCA Contract PH22-68-27, Rept. 1134-1, 388p., Nov. 1968. 136 refs.
CPSTI: PB 187771

Aircraft are small contributors of pollutants in metropolitan areas; but in the vicinity of air terminals, the density of pollutant emissions and the resulting concentrations are comparable to emission densities and concentrations in adjacent communities of the same pollutants from other sources. Exhaust emissions of primary concern are carbon monoxide, organics and nitrogen oxides, emitted as gases or vapors, and particulate matter consisting mainly of lead compounds or carbon. Turbine engine emissions are most serious during idle and taxi conditions, whereas piston engine emissions of CO and organics are high during all operating modes except cruise, perhaps due to afterburning. Nitrogen oxide emissions by turbine engines are greater than those from piston engines, which is less than from automobile engines of comparable size or fuel consumption. Emissions of all aircraft pollutants are expected to increase with more activity and changes in equipment; but reduction of emissions could be accomplished by combustion chamber modification, exhaust treatment systems, and curtailing ground operations of transport aircraft, although no practical methods have been developed for reducing nitrogen oxide emissions. (Author conclusions modified)

2343 APTIC NUMBER 20341

Ochiai, H. and T. Hanya
POLLUTION BY BHC IN PRECIPITATION. (BHC ni yoru kosui no osen). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):103, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Very little has been done on the organic chlorine insecticides such as DDT and BHC that become airborne during the spraying and that eventually come down with rainwater. In order to evaluate the quantity of agricultural insecticides supplied to the ground during rainfall, the concentration of BHC in rainwater as well as in the atmosphere was measured. The results indicated that even in urban areas where agricultural activity is small, BHC exists in rainwater, leading to the surmise that there is extensive pollution due to BHC. The high BHC content in rainwater during the summer rather than in winter is considered to have some relationship with the spraying period. However, there was no clear relationship between the BHC concentration and meteorological conditions. Even after filtering the rainwater with an HA type millipore filter, the content of BHC was not greatly influenced, indicating that the chemical exists in the dissolved state.

2344 APTIC NUMBER 20928

Olsen, Douglas and James L. Haynes
PRELIMINARY AIR POLLUTION SURVEY OF ORGANIC CARCINOGENS. A LITERATURE REVIEW. Litton Systems, Inc, Silver Spring, Md., Environmental Systems Div., Contract PH 22-68-25, NAPCA Pub. APTD 69-43, 117p., Oct. 1969. 296 refs.
CPSTI: PB 188090

The types, effects, sources, abatement methods, economics, and analysis methods of organic carcinogens are reviewed; an appendix with tabular material from selected references is included. Organic carcinogens are categorized as polynuclear aromatic hydrocarbons (PAH), polynuclear heterocyclic and oxygenated compounds, and alkylating agents. The major emission sources of organic carcinogens, particularly of PAH, are heat-generation sources such as burning coal, oil, and gas; refuse burning; motor vehicle exhaust; and industrial processes. Of these, heat generation accounts for more than 85% of the PAH while the other three sources each account for about 5% of the total. Epidemiological studies indicate that air pollution may play a role in lung cancer induction. Certain organic carcinogens normally present in polluted air, particularly benzo(a)pyrene, increase tumor incidence in experimental animals. In addition, animal studies indicate that other organic compounds may have synergistic or antagonistic effects. In 1966, the average ambient air concentration of benzo(a)pyrene in the U. S. was approximately 0.003 micrograms/cu m for urban areas and 0.0003 for nonurban areas. Data indicate that benzo(a)pyrene represents only a small percentage of the total amount of PAH found in the atmosphere. Methods of analysis are available which involve the use of extraction and chromatographic techniques for separation of the compounds followed by analysis with spectral methods. (Author abstract modified)

2345 APTIC NUMBER 21362

Oneyama, Naotake, Sunao Kawai, Tadahiro Machiyama, and Mutsuo Koizumi
EXPERIMENTAL STUDIES ON THE APPLICATION OF PRE-COMBUSTION METHOD WITH FLUE-GAS RECIRCULATION TO THE REHEATING FURNACE (2ND REPORT). Text in Japanese. Waseda Daigaku Rikogaku Kenkyusho Hokoku (Bull. Sci. Eng. Res. Lab., Waseda Univ.), no. 41:29-37, 1968. 8 refs.

A pre-combustion method with flue-gas recirculation is very useful for atmosphere control and temperature control for the furnace. Investigations in which the secondary flue-gas recirculation is introduced to the heating chamber are reported. The temperature of the heating chamber can be controlled for the range of 600 C - 1000 C by manipulating the secondary flue-gas ratio 0 - 300%. Change of the secondary flue-gas recirculation ratio has no influence on the 0.5% oxygen combustion. This means that the ratio can be handled as a manipulated variable to control the temperature. Combustion gas temperature was considerably uniform. Discussions on the transient performance and contributions to the design of the reheating furnace are also included.

2346 APTIC NUMBER 21069

Patterson, Clair C. and Joseph D. Salvia

LEAD IN THE MODERN ENVIRONMENT. HOW MUCH IS NATURAL? Sci. Citizen, 10(3):66-79, April 1968. 38 refs.

From isotope dilution studies of changing lead concentrations in polar snows of recent centuries and in seawater, lead concentrations apparently have increased about four hundred per cent between 1750 and 1950, and by about another three hundred per cent since 1940 near the North Pole. Samples of snow were collected in Thule, Greenland, from the vertical faces of ancient glaciers at the edges of the ice caps (800 B. C.), from deep tunnels at the polar research station Camp Century (200 years ago), and from surface snow layers in undisturbed virgin regions of the arctic. Data gathered in Antarctica were in sharp contrast with the Greenland results and suggest that the increase in lead content of Northern snows is due to atmospheric contamination; most industrial contamination of the air occurs in the northern hemisphere, and the prevailing air currents set up an effective barrier against the transmission of airborne contaminants to the southern hemisphere. Measurements taken in the Atlantic, Pacific, and the Mediterranean show that the recent distribution of lead in sea waters follows a pattern of relatively high surface concentrations which decrease sharply with depth. Much of the lead entering the stomach passes through the gastrointestinal tract unabsorbed; for a unit of lead entering the lungs and a unit of lead entering the stomach, nearly an order of magnitude greater fraction is absorbed into he body by the lungs. In the U. S., the significant range of blood lead is from about 0.05 parts per million to 0.4 parts per million, with a mean level of about 0.25 parts per million, while the mean body burden is about 200 milligrams of lead; a conservative estimate of average lead concentrations in existing urban atmospheres is about 1.3 micrograms of lead per cubic meter.

2347 APTIC NUMBER 20422

Rappenne, M.
NICKEL STEEL IN STORAGE TANKS FOR LIQUEFIED METHANE PROBLEMS OF WELDING AND CONSTRUCTION 9%. Welding Metal Fabric., vol. 31:378-380, Sept. 1963.

Plates, 0.118 to 0.27 in. thick, of nickel steel (composition less than 0.07% C, more than 9.25% Ni, 0.4 to 0.65% Mn, less than 0.05% (S+P), 0.15 to 0.30% Si), with a minimum tensile strength of 63 kg/sq.mm., and a minimum elongation of 16% were used to fabricate by welding the interior tanks for storage and transportation of liquid natural gas at a temperature of - 163 C at atmospheric pressure. The details of this process described include cutting the plates, their hot and cold forming, electric welding with Inconel - type electrodes, fabrication of these electrodes, welding currents used, destructive and nondestructive testing of the welds, and the welded structures. Special features of the fabrication of two tanks are considered in considerable detail: a 29 ft dia, 29 ft high cylindrical tank with a conical top of 17,650 cu ft capacity and a 15 ft times 15 ft base, 19.4 ft high 9-compartment transport tank of 4.236 cu ft capacity. The designs of these tanks are shown in line drawings, including their appearance at different stages of their fabrications. In the vertical welds of 0.15 in. thick cylindrical plates of the larger tank, there was a marked tendency to tranverse cracking of the weld metal. In plates 0.2, and more in. thick, this weld defect did not occur. The repair of these defects is a very delicate operation. Similar welding difficulties occurred with the smaller tank.

2348 APTIC NUMBER 20564

Reh, L.
INCINERATION AND THERMAL CRACKING OF LIQUID AND PASTEOUS REFUSE. (Verbrennung und thermische Spaltung fluessiger und schlammfoermiger Industrie-Abfalle). Chem. Ing. Tech. 39(4):165-171, 1967. 22 refs. (Presented at the 128th Dechema Meeting, Frankfurt/Main, April 1, 1968.) Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa. Science Info. Services, 23p.

The following are the decisive factors in selecting the method, the furnace system, and the reaction conditions for incineration or thermal cracking of industrial sludges: combustibility, volatility, and toxicity of the individual components; the water content; the mineral substances; and corrosive compounds. The most common types of furnaces (such as combustion chambers, story of fluidized bed furnaces) are surveyed, and their design, mode of operation, and field of application are discussed. Most incinerator plants use both combustion and thermal cracking. The legal requirements of total residueless combustion of all toxic organic components demand combustion temperatures of at least 800 C in the actual combustion zone of the furnaces. With many residues, this temperature cannot be reached without auxiliary fuel. A rotary burner, spray burner, an atomizing nozzle, a story furnace, and a fluidized bed furnace are illustrated. The fluidized bed incineration with a turbulent layer of inert material may be also used for thermal cracking of waste sulfuric acid from inorganic or organochemical plants. The waste acid concentrated to an acid contents of 45% (including solid substances, mostly sulfates) is pumped into the turbulent layer of sand, heated by an auxiliary burner, and cracked to water vapor, O2, and SO2. The sulfates are converted to oxide, and organic substances are incinerated. The spent hydrochloric acid and iron chloride containing pickling baths are thermally cracked.

2349 APTIC NUMBER 20414

Rengstorff, George W. P.
FACTORS CONTROLLING EMISSIONS FROM STEELMAKING PROCESSES. Open Hearth Proc., vol. 45:204-219, 1962. 7 refs.

The possibility of modifying the form of iron oxide smoke, so that more effective and/or less expensive smoke-elimination devices could be used is considered. The new experimental data, presented in the form of graphs, were obtained either from a top-blowing process in a bessemer converter, or from a direct study of vaporization of iron oxide. The effect on the formation of iron-oxide smoke of the oxygen jet velocity, the carbon content of the iron, the temperature of the metal, water additions, other hydrogeneous gases, and the slag formation are presented. Hypotheses on the mechanism of iron-oxide smoke formation are

discussed. Both industrial practice and laboratory studies lead one to the conclusion that two conditions must exist simultaneously for iron-oxide smoke to form in objectionable quantities: a mechanism for moving Fe or a Fe compound from the bulk of the liquid metal into the gas, either as a metal vapor or as an aerosol; a gaseous medium which is, at least slightly, oxidizing close to the bulk of the liquid metal. A previously suggested mechanism which seems to explain most of the known facts, is the vaporization of metallic Fe from a clean area of the surface of the liquid metal and its reaction with oxygen in the gaseous medium under formation of nonvolatile FeO. The present studies brought out the need for an understanding of the role of the dynamics of flow of both metal and gas in the process of smoke formation.

2350 APTIC NUMBER 21166

Rutz, P.
BOILER PLANTS FOR BURNING INDUSTRIAL WASTES. Sulzer Tech. Rev. (Switz.), no. 3:99-108, 1968.

Not only the shape and chemical composition of industrial wastes but their calorific value and moisture content place special requirements on an incinerator boiler and grate. The chemical composition may dictate additional measures for protecting heating surfaces against corrosion. A high ash content in the fuel will have to be allowed for in grate design. The size of the grate will be decided by the hourly weight of the waste to be burned and the calorific value of the material. Most solid fuels in the form of pieces or chips can be burnt properly on simple stationary step grates, provided a second grate follows the step grate. These grates can be used in water-tube or smoke-tube boilers. Water-tube boilers are described that are capable of firing waste alone, waste together with oil, or oil alone. Using special charging and burner arrangements, it is even possible to fire solvents in combination with oil firing. A moving burn-out grate with air cooling below provides for the automatic ejection of ash and clinker at the bottom of the boilers. Rubber and plastic wastes can be fired satisfactorily only with the addition of light fuel oil burners. When large quantities of refuse are delivered to a boilerhouse in a short time, bunkering installations should be provided for short-term storage. In addition, waste-fired boilers must be equipped with efficient electrostatic precipitators, and the dust content of the flue gas and its grain size must be determined.

2351 APTIC NUMBER 21191

Sakagishi, Shokichi
ENVIRONMENTAL SECURITY. (Kankyo no anzen). Text in Japanese. Genshiryoku Kogyo, 16(4):129-132, April 1, 1970.

In view of the anticipated growth of nuclear power plants, protection of the environment for both plant workers and residents of surrounding areas must be insured. The major procedures followed by the Atomic Energy Commission of Japan to evaluate environmental security around an atomic plant are as follows: (1) inspection of the dispersion of radioactive substances to the atmosphere by the Pasquill method, which is not applicable to gamma radiation and (2) inspection of discharged waste water to determine if it meets present emission standards. At the present time, the effect of sea water or streams in diluting waste water and the waste concentrations in marine products are unknown, as is the cumulative effect of the wastes on human health. A recent report by the Commission indicates that emission rates of radioactive contaminants contained in wastes are more important than total emission levels. This means that, even when emission levels are low, wastes should be discharged only when the radioactive contaminants are subject to the constant possibility of irradiation through direct effects as well as through the indirect one of the food chain. It is recommended that the emisssion rate before discharge be measured by an authorized body and that the effect of mass emissions from all plants in the area of an atomic energy plant be checked. Since the accidental release of radioactive substances from plants already in operation or under construction appears to be minimal, the remaining security problem is the location of the treatment facility for solid wastes.

2352 APTIC NUMBER 21109

Schroeder, Henry A.
AIRBORNE METALS. Sci. Citizen, 10(3):83-88, April 1968. 18 refs.

The frequency of cadmium, lead, and tin in the lungs of people from every country but Africa suggests industrial contamination as the source; lead and cadmium are among the elements known to shorten the life-span of mice and rats. Lead poisoning in human beings is a long-recognized problem, and cadmium has been linked to at least one chronic disease of human beings, high blood pressure. It is likely that cadmium enters the air as a by-product of industrial processing of zinc, and the principle source of airborne lead is undoubtedly tetra-ethyl lead, an anti-knock agent added to gasoline since 1924. Although average lead concentrations in the air are not considered high, varying from 0.2 micrograms per cubic meter on the Great Plains and Rocky Mountain areas to 0.7 micrograms per cubic meter in New England and the Pacific Coastal states, concentrations of six micrograms per cu m, and in extreme cases seventeen to forty-five micrograms or more, have been measured in cities, especially on traffic-crowded streets or highways.

2353 APTIC NUMBER 20706

Shigeta, Y., Y. Hoshika, T. Ishiguro, and S. Tsucaihashi
THE RESEARCH OF BAD ODOR ON THE FISH MEAL PLANTS. (Gyochokotsu shorikojogun no akushu chosarei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):86, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

In Shimonoseki, four plants in fishmeal and feather meal production as well as rendering were investigated as the source

of obnoxious odors in the area. For all plants, the most odorous emissions originated from the fish meal dryers and the exhaust of the odor control equipment. Various strengths of odor are tabulated according to the emission source and the types of products. From odor measurements of the surrounding area by the syringe method, most of the extensive odor pollution was again found to originate from the dryers as well as the raw material storerooms. A questionnaire survey was conducted of the local residents, concerning meteorological conditions and subjective opinions on odors; it became evident that the odors from the dryers are spread out by the westerly wind, with high intensity even half a kilometer away. This influences the daily life of the residents as far as one to two kilometers away.

2354 APTIC NUMBER 21152

Stahl, G.
TRANSPORT OF LNG FROM THE ATLANTIC COAST TO SWITZERLAND BY ROAD. Inst. of Gas Technology, Chicago, Ill. Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 12p. 11 refs. (April 7-12, Paper 6-39).

A specially designed road tanker was built for the intermittent transportation of 8 metric tons of liquefied natural gas from Nantes on the French Atlantic Coast to Northern Switzerland. Conformity with a variety of national and international laws governing truck specifications was required. The semi-trailer truck is a double-shell container with a vacuum powder unsulation; the inner tank has a capacity of about 18,500 liters. A system of supports includes vertical loads taken on each long side by six straps resting on a rail, through intermediate Teflon bearings, which runs along the whole length of the outer shell; the rail can be tilted to absorb centrifugal stresses as well. Pulland press anchors of 9% nickel-steel take up the horizontal loads. The forces which determined the tank dimensions are discussed, and the fittings, safety devices, and experiences on several trips are briefly noted.

2355 APTIC NUMBER 20586

Stahl, Quade R.
PRELIMINARY AIR POLLUTION SURVEY OF ETHYLENE: A LITERATURE REVIEW. Litton Systems, Inc., Silver Spring, Md., Environmental Systems Div., Contract PH 22-68-25, NAPCA Pub. APTD 69-35, 54p., Oct. 1969. 118 refs.
CFSTI: PB 188069

Ethylene is a phytotoxicant which interferes with the normal function of plant hormones and regulators. Furthermore, ethylene undergoes photooxidation with nitrogen oxides, resulting in the formation of formaldehyde, carbon monoxide, and ozone. The major sources of ethylene air pollution are the chemical industry and the exhaust from automobiles. Air samples taken recently in California indicate that the average ethylene concentration in large metropolitan areas ranges from 40 to 12 micrograms/cu m, with maximums as high as 820 micrograms/cu m. As the total production of ethylene by the major sources is predicted to increase at a steady rate, air pollution by ethylene is likely to increase, unless control procedures are implemented. Suitable control methods generally include the technique of combustion adsorption methods, and vapor recovery systems employed for other hydrocarbons. However, ethylene emissions from automobile exhaust are not yet effectively controlled. (Author abstract modified)

2356 APTIC NUMBER 12266

Steinberg, M., J. Powell, M. Beller, and B. Manowitz
HYBRID FOSSIL-NUCLEAR FUELED MHD POWER CYCLES. Brookhaven National Lab., Upton, N. Y., 15p., June 1968. 1 ref.
CFSTI: BNL 12569

The H2-O2, the CO-O2, and the CO + H2-air systems are described and the advantages and disadvantages enumerated. With the H2-O2 system, coal is reformed entirely to hydrogen using the gasifying and shift reactions. The ash, hydrogen sulfide, and carbon dioxide are removed, and the resulting hydrogen is burned in the MHD with oxygen from an air separation plant. Water is added to the combustor as a diluent for temperature control. It is a fully condensing system, Cs removal is simpler, and the MHD generator is small. But large reforming and oxygen plants are needed. A high temperature heat transfer material is required in the gasifier. With the CO-O2 system, coal is gasified with recycled CO2 to form CO. the ash and H2S are removed, and the clean CO is burned with O2 from an air separation plant. Additional CO2 recovered from the exhaust gases is added to the gasifier and combustion to act as a diluent for temperature control. The highest efficiency, potentially 70% or higher, can be obtained in this system. The reforming investment is reduced. A more efficient MHD generator can be used. Recovery and recycling of the CO2 is a disadvantage. The cycle is non-condensing. With the CO + H2 -air system, coal is reformed by partial oxidation with steam to CO and H2. The oxygen for the reformer is obtained from an air separation plant. The ash and H2S is removed and the clean CO and H2 is burned in the combustor using compressed preheated CO air. Nitrogen is used as diluent. The advantages are that the plant size is reduced by a factor of 4 and the reforming investment is reduced because there is no shift reaction. The need for operating with a balanced or slightly reducing flame in the combustion gases fed to the MHD to minimize formation of nitrogen oxides is a disadvantage.

2357 APTIC NUMBER 21624

Steinkohlenbergbauverein, Essen (West Germany), Arbeitsgruppe Kokereiemissionen
RESTRICTION OF DUST EMISSION IN COKE QUENCHING COKING PLANTS AND GASWORKS. (Auswurfbegrenzung von Staub beim Loeschen von Koks Kokereien und Gaswerke). VDI (Ver. Deut. Ingr.) Richtlinien, no. 2303, Nov. 1966. Translated from German by D. Ben Yaakov, Israel Program for Scientific Translations, Jerusalem, 4p.
CFSTI: TT 68-50469/10

The technology of coking plants and gasworks is reviewed with respect to the emission of dust from the quenching towers. The quantity of dust emitted during quenching may vary at different

points during the quenching process, from batch to batch in the same plant, and from plant to plant, and depends on the nature of the charge and the dimensions and shape of the quenching tower. The former is affected by the nature of the input coal, the final coke temperature, and the operation of the coking oven. The higher the quenching tower, the greater will be the draft and resulting flow velocity of the quenching vapors; consequently, more dust will be emitted from a higher tower. However, the tower must also be high enough to avoid nuisance and environmental damage. Besides design modifications, dust emission can also be reduced by reducing the amount of drawn-in air to reduce the flow velocity, by the impact effect of built-in grates, screens, or baffles, and by spraying into the quenching-steam cloud. Newly erected quenching towers must be equipped with appropriate control devices, and must be designed to meet prevailing emission limits. An appendix describes the apparatus and procedure for sampling dust emission from quenching towers.

2358 APTIC NUMBER 21423

Stoefen, Detlev
PROPHYLACTIC MEASURES AGAINST POISONING BY LEADED GASOLINE-CRITERIA AND CONSEQUENCES. (Die Prophylaxe der mit der Benzinverbleiung verbundenen Gefahren - Kriterien und Konsequenzen). Text in German. Staedtehygiene(Oelzen/Hamburg), 21(4):94-97, April 1970. 23 refs.

Seventy percent of the lead in gasoline is emitted with the exhausts. The dangers of lead poisoning (genetic defects, brain strokes, etc.) have been pointed out repeatedly, but no maximum allowable concentrations have yet been worked out with the exception of the Soviet Union, where the limit was determined to be 0.0007 mg/cu m. Measurements near stop signs in Hamburg revealed a lead concentration of about 0.002 mg/cu m; in a tunnel, 0.004 mg/cu m; and in the large cities of the Rhine Valley, the lead concentration fluctuated between 0.5 and 12 micrograms cu m. As indicated by delta-amino levulin acid discharge tests, latent lead poisoning is widely spread in motorized countries. Examination of 48 policemen in Basel indicated that they discharge 3 to 7.5 mg delta-amino levulin acid/day. The limit concentration was 6 to 9 mg/day.

2359 APTIC NUMBER 20553

Sullivan, Ralph J.
PRELIMINARY AIR POLLUTION SURVEY OF ODOROUS COMPOUNDS. A LITERATURE REVIEW. Litton Systems, Inc., Silver Spring, Md., Environmental Systems Div., Contract PH 22-68-25, NAPCA Pub. APTP 66-42, 244p., Oct. 1969. 443 refs.
CPSTI: PB 188089

Odors may cause mental and physiological effects in humans, such as nausea, headache, loss of sleep, loss of appetite, impaired breathing, and in some cases allergic reactions. Community and personal pride and status may be adversely affected. No information on the effect of odorous air pollutants on the health or behavior of domestic, commercial, or experimental animals was found in the literature. The petroleum industry, petrochemical plant complexes, chemical industry, pulp and paper mills, coke ovens, coal, iron-steel industry and foundries, food processing, meat industry (including livestock slaughtering, inedible rendering of animal matter, fish processing, tanneries, etc), combustion processes (including diesel engines), and sewage are listed as sources of odors. The literature contains no quantitative data on the odor concentration in ambient air. Surveys have been made, but they show only the detective disagreeable odors and not their intensity. Abatement methods fall into several categories: combustion, absorption, adsorption, odor masking, odor removal, chemical control, biological control, and containment. Combustion is generally accepted as the best way to deodorize malodorous gases. Oxidation at 1,200 F or above usually gives satisfactory results. Economically, odor pollution depresses property values. The human nose is the only reliable detector, and several laboratory and field methods (organoleptic methods, such as the vapor dilution technique and the syringe dilution techinque) and instrumental methods (such as gas chromatography) have been developed to quantify human observations.

2360 APTIC NUMBER 20585

Sullivan, Ralph J.
PRELIMINARY AIR POLLUTION SURVEY OF NICKEL AND ITS COMPOUNDS: A LITERATURE REVIEW. Litton Systems, Inc., Silver Spring, Md., Environmental Systems Div., Contract PH 22-68-25, NAPCA Pub. APTD 69-41, 69p., Oct. 1969. 113 refs.
CPSTI: PB 188070

As determined by a literature search, inhalation of nickel or its compounds can cause lung cancer, sinus cancer, other disorders of the respiratory system, or dermatitis. No information was found on the effects of emissions of nickel on commercial animals, plants, or materials. The most likely sources of nickel in urban air are metallurgical plants using nickel, engines burning fuels containing nickel additives, coal and oil combustion, nickel plating facilities, and incineration of nickel products. In 1966, the national average atmospheric concentration of nickel was 0.032 micrograms/cu m, while the national maximum concentration was 0.690 micrograms/cu m. Nickel air pollution usually occurs as particulate emissions and is controlled with the total particulates by dust handling equipment such as bag filters, precipitators, and scrubbers. The only serious abatement problem is with gaseous nickel carbonyl, which must be thermally decomposed before it can be removed as particulate. No methods for controlling nickel emissions from motor exhaust are cited in the literature. Analytical methods are available to measure nickel at the 0.006 microgram/cu m level and nickel carbonyl at the 7 microgram/cu m level.

2361 APTIC NUMBER 20929

Sullivan, Ralph J. and Yanis C. Athanassiadis
PRELIMINARY AIR POLLUTION SURVEY OF ASBESTOS. A LITERATURE REVIEW. Litton Systems, Inc., Silver Spring, Md., Environmental Systems Div., Contract PH 22-68-25, NAPCA Pub. APTD 69-27, 94p., Oct. 1969. 247 refs.
CPSTI: PB 188080

The effects, sources, abatement, economics, and methods of analysis of asbestos are reviewed; appendices are provided containing tabular material from selected references together with a brief discussion of respirable asbestos fibers. Inhalation of asbestos may cause asbestosis, mesothelioma (a rare form of cancer frequently occurring in asbestos workers), or lung cancer. These diseases are fatal, once they are established. The dose necessary to produce asbestosis has been estimated to be 50 to 60 million particles per cubic foot-years. No information is available on the dose necessary to induce cancer. Random autopsies of lungs have shown asbestos bodies in the lungs of one-fourth to one-half of samples from urban populations. Thus, the apparent air pollution by asbestos reaches a large number of people. The likely sources of asbestos air pollution are uses of the asbestos products in the construction industry and asbestos mines and factories. Observations in Finland and Russia indicate that asbestos does pollute air near mines and factories. However, no measurements were reported of the concentration of asbestos near likely sources in the United States. A concentration in urban air of 600 to 6,000 particles per cubic meter has been estimated. Bag filters have been used in factories to control asbestos emissions; the cost of this type of control in a British factory was approximately 27.5% of the total capital cost and about 7% of the operating cost. No satisfactory analytical method is available to determine asbestos in the atmosphere. (Author abstract modified)

2362 APTIC NUMBER 20961

Taylor, Francis H., Zenophon G. Tomaras, and William E. Scott
A SURVEY OF EMISSIONS FROM RESIDENTIAL OIL-FIRED HEATING UNITS.
Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf., Philadelphia, Pa., 1963, 30p. 6 refs. (Oct. 24.)

The emissions from residential heating units using No. 2 fuel oil were surveyed including a few light industrial plants using No. 6 fuel oil to determine whether the emissions are comparable to those from No. 2 fuel. Infrared and chromatographic analyses were used for stack gas samples, along with aerosol sampling. Assuming that all the carbon in the fuel was converted to carbon dioxide and carbon monoxide, the ppm units were converted to the units of 'pounds per 1000 gal of fuel burned'. The concentrations of hydrocarbons emitted were less than 1 lb. Twenty of the residential units tested produced less than 8 lbs of nitric oxide, while another 20 units produced less than 4 lbs of nitrogen dioxide. The concentrations of CO produced by 10 units amounted to less than 1 lb, while a total of 21 units produced less than 16 lbs. Eleven of the residential units emitted less than 32 lbs of sulfur dioxide, while all 25 units produced less than 64 lbs. The quantity of aerosol produced by 13 units was less than 6 lbs, and the total of 20 units was less than 12 lbs. Emissions from industrial units were roughly comparable to those of the residential units, but they produced a maximum aerosol concentration of 14 lbs, and concentrations of SO2 ten times higher than those emitted by the residential units. Fluorescence spectrometry showed that a typical unit produced particulates containing 11 polycyclic aromatic hydrocarbons. Installation of a proper nozzle and elimination of air leaks resulted in negligible amounts of polycyclics. Adjustments of the fuel/air ratio of 8 residential units reduced the range of aerosol emissions from 3.6 - 26 lbs, to 0.24 - 5 lbs. (Author conclusions modified)

2363 APTIC NUMBER 21626

VDI (Verein Deutscher Ingenieure) Kommission Reinhaltung der Luft, Duesseldorf, Germany, Unterausschuss Abfallverbrennungskleinanlagen and VDI (Verein Deutscher Ingenieure) Fachgruppe Haustechnik, Duesseldorf, Germany
RESTRICTION OF EMISSION WASTE INCINERATION IN PLANTS WITH THROUGHPUT OF UP TO 1,500 KG PER HR. (Auswurfbegrenzung Abfallverbrennung in Anlagen mit Durchsatzleistungen bis zu 1500 kg/h Abfall). VDI (Ver. Deut. Ingr.) Richtlinien, no. 2301, Feb. 1967. 35 refs. Translated from German by D. Ben Yaakov, Israel Program for Scientific Translations, Jerusalem, 9p.
CFSTI: TT 68-50469/13

The formation and control of emissions from small solid-waste incinerating plants close to the waste source, rather than from large central incineration plants, are reviewed, and emissions limits are given. General design and construction requirements are given for release of flue gases, auxiliary burners, secondary combustion, inspection and measuring openings, charging gear, incinerator premises, operation, and heat recovery processes. Factors affecting dust and soot formation in the different parts of the incinerator are outlined, as well as engineering means of removing particulate and gaseous components in the flue gases, and the equipment, operating, and maintenance requirements for restricting emission. Smoke-plume color must be less than No. 2 on the Ringelmann scale for running operation with any type of waste, and less than No. 1 with the waste type for which the unit is designed. Particulate emission may not exceed 200 mg/cu m STP for moist flue gas (with CO2 content of at least 7%) at the stack outlet, to be determined by gravimetric measurement during a period representative of average operation.

2364 APTIC NUMBER 21517

Vedensky, D. N.
HOW THE SO2 PROCESS WORKED ON THREE KIDS MANGANESE ORE. Eng. Mining J., 147(7):58-64, July 1946.

A sulfur-dioxide process for producing high-grade manganese oxide to be blended with low-grade ores and furnish feed for ferromanganese furnaces is described. On the basis of a plant near Las Vegas to treat 1000 tons a day of 20% manganese ore from the Three Kids mine, it should be possible to produce nodules at a cost of .50 to $.60 per ton. In the process, for which a flowsheet is given, ore from the bedding bins was dry-ground, then pulped with mill solution and leached in packed towers against incoming sulfur dioxide gas, thus converting manganese dioxide into soluble manganese sulfate and some thionates. In purifying the pregnant manganese solution, iron and aluminum hydroxides were precipitated and copper was brought down by zinc dust. Release of SO2 in the evaporator when the pH of the pregnant solution was around 3 was solved by adding sulfuric acid, which converted bisulfite ions to sulfurous acid, and then adding small amounts of

ground raw ore to oxidize the acid. The neutralized solution was evaporated to produce crystals, filtered, and then kiln-roasted to produce manganese oxide and SO2, and the later going back to the leaching plant together with make-up SO2. Sulfur was lost from the plant chiefly in the exit gas from the towers, as alkali sulfate in the nodules, in solution spillage, and in the incomplete roasting of manganese sulfate. Plant experience and difficulties in the crushing and grinding process, leaching plant, control of calcium sulfate, evaporation, nodulizing, and roasting are reviewed in detail.

2365 APTIC NUMBER 20890

Walker, D. R.
SULFUR IN PRECIPITATION IN CENTRAL ALBERTA. Can. J. Soil Sci., 49(3):409-410, 1969. 2 refs.

Rainwater and snow samples were analyzed to determine if increased sulfur in the atmosphere due to gas and oil production and sulfur extraction plants in west central Alberta explained a reduction in the number of tests responding to sulfur fertilizer on Gray Wooded soils in this region. Sulfate sulfur was determined by a modification of a radioactive barium procedure. Samples collected within a radius of 16 to 24 kilometers from the sulfur extraction plant did not contain more sulfate sulfur than samples collected at more distant locations, while the sulfate content of individual samples ranged from 0.16 to 3.65 parts per million. With total average precipitation approximately 45 to 56 centimeters, the total annual deposition of sulfate sulfur in precipitation was 2.2 to 4.4 kilograms per hectare. Other sources of atmospheric sulfur evidently are not contributing significantly to the sulfur requirements of plants, since fertilizer tests on legumes at the rain collection sites gave very pronounced increases in yield from the application of sulfur fertilizer in recently developed farming districts. At several locations, 5.6 kilograms of sulfur per hectare were insufficient to produce maximum yields.

2366 APTIC NUMBER 21167

Walters, W. J. and J. A. Ward
FACILITIES FOR IMPORTATION OF LIQUID METHANE INTO CANVEY ISLAND. Inst. Gas Eng. J. (London), vol. 6:182-206, March 1966. 8 refs.

The background to the scheme for importing natural gas in liquid form is briefly reviewed, and a general description given. The design and construction of the reception facilities at Canvey Island are considered in detail, and the method of operation and experience are described. At the very low temperature of liquid methane, -160 C, many metals become brittle. Aluminum and its alloys have been used for large vessels and pipe-work. For other parts of the equipment, such as castings for valves and pumps, stainless steel and cast aluminum have been used. Provided certain requirements are met, the storage and handling of liquid methane is considered to be less dangerous than that of other petroleum products. The main sections of the plant, such as storage tanks, evaporator, pumps, and water system are described. The handling of boiloff gas and terminal operations are also described. The plant at Canvey has proved to be reliable and flexible in operation. The construction of more equipment for the storage and gasification of liquid methane is recommended.

2367 APTIC NUMBER 21151

Ward, J. A. and R. H. Mildrew
LATEST DEVELOPMENTS AT CANVEY ISLAND. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 14p. 1 ref. (April 7-12, Paper 4-17).

An account is given, along with the difficulties encountered, of the construction of the first of four 300,000-barrel frozen inground storage units which are being built at the Canvey Island Liquefied Natural Gas Terminal in England to provide storage for peak load purposes; the new units will increase total storage capacity at the terminal from 26,000 to a total of 110,000 long tons. The need for added capacity and for greater flexibility of operation, as well as the reasons for selecting inground units, is discussed. Also reviewed in some detail are the design of the units, the method of freezing, suitability of the soil strata, the freeze tube arrangement, and methods used to determine the extent of the ice wall. Design features include the spherical aluminum roof, concrete ring beam, gas sealing arrangement and insulation for roof and surrounding ground. Liquid fill, discharge and boil-off gas arrangements are described. A plant is described for transferring cold energy from outgoing base load LNG to the calcium chloride brine being circulated through the freeze tubes for ground freezing. (Author abstract modified)

2368 APTIC NUMBER 20630

Yagi, K., H. Konokawa, T. Inoue, M. Aizaki, and S. Masuda
ATMOSPHERIC POLLUTION FROM FOUNDRIES. (Chuzokojo ni okeru kogai hassei jokyo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):145, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Within Osaka, the number of metal foundries engaged in intermediate and final processing constitut a large proportion of the small medium industry; since they are intermingled in the residential areas, they pose a large pollution problem. The problem, in connection with future land use and city planning, was investigated by sampling the representative pig iron and non-iron metal foundries. Emphasis was placed on the concentration of sulfur dioxide gas, concentration of fine dust particles, and concentration of heavy metals in these particles. Technically, the results showed that it is possible to aggregate all the small-scale foundries in one area and to localize the pollution problem, but the economic and sociological problem such as purchase of factory site by the city to induce such an action and availability of labor cannot be solved by technology alone. As for the pollution itself, the installation of dust collectors in the major sources is necessary; for small-scale operations that involve primitive methods, modernization of process precedes the abatement problem.

2369 APTIC NUMBER 21444

Yamaki, N., Aoyama, and S. Nakamura
EXHAUST HYDROCARBON COMPOSITION OF AUTOMOBILE--LP GAS AS THE FUEL. (LP gasu judosha no haikitankasuisososei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):89, 1969. (Proceedings of the 10th Annual Meeting of Japan Society of Air Pollution, 1969.)

The exhaust gas from an LP-gas automobile was analyzed by means of the standard NDIR method and a gas chromatograph with a scrubber for various types of hydrocarbons. The relationship between fuel composition and driving conditions and the exhaust gas, in addition to the photochemical reaction of the exhaust hydrocarbon, was discussed. The experiment was conducted on a 2000 cc class Japanese passenger car (four cylinders and four cycles) with different types of hydrocarbon gases as fuel. The exhaust gas produced under different driving conditions as simulated by the chassis dynamometer were examined in terms of the diverse concentrations of carbon monoxide, carbon dioxide, and hydrocarbons. For normal driving conditions, the entire composition of hydrocarbons in the exhaust gas was analyzed by means of a gas chromotograph.

2370 APTIC NUMBER 20674

Abelitis, Andris
APPARATUS FOR HEAT TREATING CEMENT RAW MATERIAL OR PRECIPITATED WASTE LIME CONTAINING COMBUSTIBLE CONSTITUENT. (Klockner-Humboldt-Deutz A. G., Cologne (West Germany) U. S. Pat. 3,491,991. 3p. Jan. 27, 1970. 1 ref. (Appl. Oct. 30, 1967, 4 claims).

Apparatus is described for heat treating cement raw material or precipitated waste lime material containing combustible constituents, wherein the waste gas pipe or duct is given a special construction to achieve complete combustion of the carbon material. By providing the waste gas duct or pipe with a downcomer portion descending to and connecting with the separator and having a larger cross section than a riser portion, the material is entrained and upwardly driven by the waste gases in the riser portion at a greater velocity than the velocity in the downcomer portion of the waste gas duct. An initmate intermixture and uniform distribution of the material over the entire cross section is produced. Since the flow of the gas in the descending portion of the waste gas duct or pipe is in a downward direction, there is no danger of the material tending to bake together even for relatively slow flow velocities, so that slow gas velocities and relatively lengthy periods during which the material is present within the waste gas duct are permitted. The cross section of the descending portion can be such that the gas velocity is only between approximately 1-5 meters per second. Thus, the combustible carbon constituents are certain to be consumed while the cement raw material is carried by the waste gas flow in suspension through the waste gas duct.

2371 APTIC NUMBER 21369

Ahlgren, Per, Sven Lemon, and Ants Teder
PREPARATION OF SODIUM POLYSULFIDES BY SOLID AND MOLTEN STATE REACTIONS. Acta Chem. Scand., 21(4):1119-1120, 1967. 7 refs.

Polysulfides were obtained from the sodium-sulfur compounds (Na2SO4, Na2S, and N12S203) available in the recovery system of a kraft pulp mill by thermal decomposition of thiosulfate, partial oxidation of sulfide, and by partial reduction of sulfate. The reactions were performed at elevated temperatures in the absence of water, at atmospheric pressure, and at restricted air contact. To prevent their partial decomposition to sulfate and sulfide, the polysulfides were cooled before dissolution in water. Thiosulfate decomposed to polysulfate and sulfate when heated to above 450 C in a pyrex vessel. On heating at 550 C for 15 min, the yields of sulfide and polysulfide excess sulfur were 11.3% and 47.2%, respectively. Partial reduction of sulfate and partial oxidation of sulfide at 900 C in the presence of carbonaceous material yielded polysulfide and carbonate. Both reactions were carried out in zirconium dioxide or carbon crucibles. The yields obtained at 900 C for both reactions are tabulated.

2372 APTIC NUMBER 20636

Aldridge, Clyde L.
STEAM DESULFURIZATION PROCESS. (Esso Research and Engineering Co., Linden, N. J.) U. S. Pat. 3,498,860. 3p., Feb. 10, 1970. 5 refs. (Appl. March 11, 1968, 10 claims.)

A process is provided for the desulfurization of heavy petroleum fractions with steam in the presence of an active, regenerateable catalyst. The process is centered on nondestructive desulfurization as distinguished from destructive desulfurization, e.g., steam cracking. The catalyst comprises a metal salt on a support. The metal is selected from groups I-A, III-B, V-B, VI-B, VII-B, VIII-B, and thorium and Lanthanide series. Appropriate salt forms include the oxides, the hydroxides, the sulfides, the sulfates, the carbonates, and hydrates of these salt forms. The most preferred catalysts are hydrated mixed rare earth oxides, hydrated lanthanum oxide, and thorium oxide. The support must be able to withstand continuous intimate contact with steam during the desulfurization reaction and frequent contact with hot gases during regeneration: alpha alumina is the preferred material. One of the most suitable feeds for the process is a petroleum fraction containing at least 10% of material boiling above 900 F. Another preferred feed is a gas oil with a boiling range about 600 to 1000 F. The feeds will contain 0.5-10 weight% sulfur. The oil, steam, and catalyst can be passed through fixed bed, fluidized bed, or slurry bed reactors, with air used to activate the feed.

2373 APTIC NUMBER 20466

Alford, B. W. and A. E. Pelt
KNOCK SUPPRESSOR FOR LARGE GAS ENGINES. Preprint, American Society of Mechanical Engineers, New York, 8p. 1969. (Presented at the American Society of Mechanical Engineers, Diesel and Gas Engine Power Division Conference, Kansas City, Mo., April 20-24, 1969.)

Tests were conducted on a single cylinder engine assembled from KVR components and provided with accessory test equipment to simulate the air-manifold pressure and the back-pressure in the exhaust manifold, and using the 'Ethyl' Anti-Knock Compound - Manganese (AK-Mn) to determine if propane with additions of an antiknock compound would be a satisfactory substitute for natural gas as a fuel for a multicylinder Ingersoll-Rand- KVR (our-stroke cycle, 17 in. bore, 22 in. stroke, 10:1 expansion ratio, 7.5:1 compression ratio scavenged and turbocharged natural-gas engine) rated at 156 bmep and 350 rpm at 125 F air-manifold temperatures. AK-Mn is an organometallic compound, methylcyclopentadienylmaganese tricabronyl whose chemical formula is $CH_3C_5H_4Mn(CO)_3$. This material is in commercial use as a smoke suppressant for turbine engines and in furnace oils. It is not particularly volatile and, in order to evaporate it into gaseous fuels, it must be injected into preheated fuel for atomization and consequent evaporation. Approximately 0.4 gram of manganese as AK-Mn per 1 therm (1 therm equals 100,000 Btu) of propane would increase the knock-limited torque 37% required to make propane equivalent to natural gas in the present context. Field tests on a KVR multicylinder engine

using propane with AK-Mn additons fully confirmed the single-cylinder tests. The AK-Mn material leaves a soft powdery deposit in the interior of the engine. It may be possible to use it as a topping agent during periods of high ambient temperatures. It may permit the use of lower-grade fuels in both standby and full-time applications.

2374 APTIC NUMBER 21280

Allan, John
THE MIGHT FILTER TO SHUT OUT DIRT AND DAMAGE. Engineer (London), 230(5958):26-29, April 2, 1970

Most filters are employed for removing contaminating solids from fuels, lubricants, and the air supply for internal combustion engines. Large numbers are also used in engineering for filtering cutting oils, in lubricating and hydraulic systems for machine tools, and in compressed air systems. The widest variety of filters is used in the chemical and process industries where fluids vary widely in their characteristics. The design, construction, and applications of a number of filter media are reviewed: paper, woven cloth, sintered metals, porous ceramics, and adsorbent materials such as activated carbon. Rotary and edge-type filter assemblies are also discussed. Temperatures and pressures are noted to have a fundamental bearing on the type of filter material and construction chosen for a particular application. The importance of determining maximum particle pore size when rating filter media is stressed. A bubble test is used for this purpose where the medium is immersed in liquid and low-pressure air is applied under the medium. The pressure of the air necessary to force the first bubbles through the pores is measured. The bubble test is used in conjunction with the conventional test dust or glass bead method. In this procedure, a sample of the fluid to be filtered is drawn through a special filtering membrane with finely ruled grid lines. The membrane is examined under a microscope and all particles are measured and counted.

2375 APTIC NUMBER 20314

Alliger, Howard
NOXIOUS RESIDUE ELIMINATOR FOR SMELTING PLANT. (Assignee not given.) U. S. Pat. 3,495,384. 2p., Feb. 17, 1970. 10 refs. (Appl. June 24, 1968, 2 claims).

A noxious soot and gas eliminator is provided for large smokestacks, which employs means for injecting fine mists and whirling the mists around the stacks, together with ultrasonic means for not only increasing grain loading of the soot, but to make the soot sticky and grow in size. Waterfall means are provided for de-misting the gases, while allowing for the exhausting of clean gas and air. The increased size of the soot particles will reduce amounts of water used in removing the soot and noxious material.

2376 APTIC NUMBER 20695

Alliger, Howard
NOXIOUS RESIDUE ELIMINATOR FOR SMELTING PLANT. (Assignee not given.) U. S. Pat. 3,495,384. 3p., Feb. 17, 1970. 10 refs. (Appl. June 24, 1968, 2 claims).

A method for eliminating substantially all the soot and noxious gases, e.g, sulfur dioxide, from large smelter smokestacks is presented which provides for the convenient exhausting of the clean air and gas to the atmosphere. A battery of spray nozzles equipped with ultrasonic resonators or whistles are mounted in a stack to deliver a finely divided mist and ultrasonic vibrations to the gases to be cleaned. The whistles cause the soot particles to grow in size and to become sticky, thereby reducing the amount of water required for their removal. Another battery of ultrasonic whistles are mounted above the nozzles for imparting a furious turbulence to the already whirling gases to cause soot gases, and water to mix. At the top of the smokestack, water headers cascade water down along screens, de-misting the gases and allowing clean air to pass out through the screens.

2377 APTIC NUMBER 20568

Alt, Christian and Paul Schmidt
COMPARATIVE STUDIES OF THE SEPARATION EFFICIENCIES OF VARIOUS CENTRIFUGAL DUST COLLECTING SYSTEMS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(7):1-4, July 1969. 5 refs. (Symposium of the VDI-Fachg uppe Staubtechnik, Wiesbaden, March 6-7, 1969, Research in Dust Removal Technology.)

Rotary flow dust separators belong to the group of axial, cross-current or drift separators. These separators are characterized by the nondiverted through-flow of the gases. Conventional cyclones are reverse-flow separators, characterized by a reverse flow of gases through the pipe. The separation efficiency of each category was compared by plotting pressure loss against efficiency and pressure drops against separation size. The results show that all particles above three micron are more economically separated by cylones, while those below three micron are best handled by rotary flow collectors.

2378 APTIC NUMBER 21378

Altekruse, Gene
TWO APPLICATIONS OF AN ON-LINE DATA ACQUISITION AND REDUCTION SYSTEM. Preprint, Society of Automotive Engineers, Inc., New York, 10p., 1969. 1 ref. (Presented at the Society of Automotive Engineers, Mid-Year Meeting Chicago, Ill., May 19-23, 1969, Paper 690498.)

Manual and on-line computer systems are compared for evaluating the performance of exhaust emission control systems for motor vehicles, and two applications for an on-line data acquisition and reduction system with step-by-step procedures are described to aid those interested in reducing the delays normally experienced with manual reduction. Manual data reduction, in addition to being tedious and time-consuming (approximately eight hours), is more error prone than an on-line system. Errors are in the form of physical procedures involved in acquiring the data and reading the strip charts, while off-line calibration of the analyzers at required intervals is also a time-consuming process

because of the physical procedure and the time required for getting the curves stored in the computer. Utilizing a digital input device, the on-line system has shortened the throughput time, defining the parameters of the succeeding dynamic cycle and entering them as predetermined. An on-line calibration system was implemented, and the analog to digital converter reads to the nearest 1/256 of a full scale reading, resulting in an increase of the data reduction accuracy of approximately 2-1/2 times. Due to the numerous investigations of the environmental characteristics that affect a truck's safe operation, a need has been generated for reducing large amounts of data recorded on magnetic tape using a 14-channel Ampex FM analog tape recorder. The manual data reduction system, using the Hughes peak distribution analyzer, requires two passes of the FM tape, one for plus voltages and the other for minus voltages for each channel of data. Due to the relatively few number of categories and the need for maximum resolution, the reduction analyst spreads the signal as wide as desired using an educated guess, and if an out-of-limits condition is encountered during the run, it must be repeated. The basic attribute of the on-line FM tape reduction system is increased throughput requiring only a single pass for the 12 channels with plus and minus voltages included. The tape normally runs at data acquisition speed giving a reduction versus acquisition ratio of 1:1, an increase in throughput of approximately 24 times the manual system.

2379 APTIC NUMBER 21590

A FIRST FOR ALABAMA GAS. Am. Gas Assoc. Monthly, vol. 46:2-3, 32, May 1964.

A liquefied natural gas facility is described that will have an initial liquefaction capacity of 4.6 million cu ft of gas per day, and a storage capacity of 600 million cu ft of gas. A vaporizing facility will consist of three individual trains of pumps and vaporizers, each with a capacity of 42.5 million cu ft of gas per day. Incoming gas at 500 psig will be treated to remove carbon dioxide and water, which would freeze out during liquefaction. Purified gas will be cooled by a cascade refrigeration system using propane and ethylene to obtain liquefaction temperatures. Normal boiloff from the storage tank will be reliquefied and fed back to storage or recompressed for distribution. The perlite-insulated, double-wall storage tank will be completely enclosed in a diked area with ample volume to contain the entire contents of the tank. Discharge lines from the tank will be diked separately so that, in the event of a broken line, the liquid spilled can be contained in a smaller area. The estimated cost of the facility is $5,300,000 (1964-1965).

2380 APTIC NUMBER 21256

LNG FOR NEW ENGLAND. Am. Gas Assoc. Monthly, 48(12):2-4, Dec. 1966.

A new liquefied natural gas facility will add additional insurance of continuity of service to New England gas consumers. Storage capacity will be one million barrels in two in-ground tanks, the perimiters of which have been frozen to make them leakproof. Granite will form the sides and bottom of the tanks. Storage level will be maintained at two feet below ground level to eliminate any danger of spillage. Dry powder extinguishers and a water and foam system will provide fire protection. Much of the plant control system is automatic, but can be operated manually and will be manned on a 24 hour basis.

2381 APTIC NUMBER 21529

LNG IN CANADA. Am. Gas Assoc. Monthly, 49(5):8-9, May 1967.

The first Canadian plant to liquefy natural gas is located at Richmond, B. C. The plant takes natural gas from a B. C. Hydro and Power Authority connection, converts it to liquid at minus 260 F, and stores it in specially constructed aboveground tanks. For return to its gaseous form, the liquefied gas is transported in tank trucks to a distribution facility 40 miles away. Initially the liquefaction facility will process about 140 cu ft of natural gas per day, but modifications designed into it will allow expansion to 500,000 cu ft per day.

2382 APTIC NUMBER 21557

Ambler, Bruce M.
OVER-THE-ROAD LNG TRANSPORT. Am. Gas J., 194(8):28-30, 32, July 1967.

Liquid methane can be conveniently and safely transported in tank trailers to supply small peak shaving operations, to meet periodic shortages, to provide a base load supply to outlying communities where pipeline construction is not economically justified, or to provide a temporary source of gas when service is interrupted. A typical tank trailer has an inner tank constructed of stainless steel, aluminum, or other metal suitable for low-temperature service and an out tank, integral to the trailer, of carbon steel designed for vacuum service. The annular space between the tanks is filled with perlite and a moderate vacuum of 50 micron is established to effectively insulate the liquefied methane. The liquid is transferred to the inner tank through a liquid 'fill and discharge' line; no transfer pump is required. Safety features incorporated into the liquid methane [illegible] trailers are small relief valves mounted on the 'fill and discharge' and 'gas return or discharge' lines, and a full relief valve mounted on the vapor line from the inner tank.

2383 APTIC NUMBER 21272

Archer, William E., Everett L. Coe, Jr., and Leo O. Reed
ELECTRICAL PRECIPITATOR AND OPERATING METHOD. (Assignee not given.) U. S. Pat. 3,485,011. 7p., Dec. 23, 1969. 21 refs. (Appl. Oct. 21, 1966, 13 claims)

An electrostatic precipitator is described which provides isolating resistance between the power supply and each individual charging electrode. A charging electrode consists of an isolating

resistance, an elongated emitting wire, and a number of tubes which are equally spaced along the wire. A number of electrode sets, consisting of one collecting and one discharging electrode, are provided. With this arrangement, a localized discharge or spark current on one electrode does not affect the other electrodes in the precipitator. The charging function is only interrupted on one electrode for a given spark current. There is an increase in the allowable peak voltage since more sparking can be tolerated without damage to the precipitator. There is a large increase in the average electrode voltage of the precipitator, because a single spark produces a voltage drop only in one electrode and such a voltage breakdown is of very short duration.

2384 APTIC NUMBER 21309

Argenbright, L. P. and Bennett Preble
SO2 FROM SMELTERS: THREE PROCESSES FORM AN OVERVIEW OF RECOVERY COSTS. Environ. Sci. Technol., 4(7):554-561, July 1970.

About 2.2 million long tons per year of sulfur is contained in the sulfur oxide gases generated in the operation of copper, zinc, and lead smelters in the western United States. Nearly 23% of this is recovered, mostly as sulfuric acid. A study was made to identify and evaluate the technological and economic problems associated with controlling the sulfur oxide emissions of these smelting operations. Three processes for control and by-product recovery were considered: the contact sulfuric acid process, the Cominco absorption process, and the ASARCO reduction process. All three are adversely affected by the low percentage of sulfur in the exhaust gases. Similarly, all are limited in optimum size, since the capital investment for larger operations off-sets the reduction in operating cost. Of the three processes considered, the contact sulfuric acid process is the least costly, both in terms of initial cost and operating cost.

2385 APTIC NUMBER 21572

Armstrong, Ted
NEW TECHNOLOGY WILL FEATURE NORTHWEST NATURAL'S LNG PLANT. Oil Gas J., 65(7):116-119, Feb. 13, 1967.

A new peak shaving plant will have a tank for the storage of liquid methane that is characterized by an inner shell with a suspended roof. The inner shell will serve as a thermal barrier but at the same time permit methane boiloff to permeate the insulated area between the inner and outer shell. This design eliminates the need for a cryogenic metal roof and also the need for a nitrogen-purge system in the insulated area between the two shells. Another innovation will be the use of molecular sieves for prepurification of the incoming gas. When reactivated, the sieves should produce a gas containing no more than 5 grains/100 scf of sulfur. A bypass valve will liquefy enough incoming gas to make up for the boiloff during periods when the system is 'holding'; normal boiloff from the tank will be compressed and turned into the distribution system. Because of this arrangement, the plant will not need a cold blower to drive boiloff vapors back through the cold box. The expander liquefaction cycle to be employed will permit operations at high pressures and thus reduce the effect of barometric changes. Total cost of the project is estimated at $3.5 million.

2386 APTIC NUMBER 21250

Armstrong, Ted A.
SOME QUESTIONS AND ANSWERS ON METHANE LIQUEFACTION. Oil Gas J., 64(2):72-74, Jan. 10, 1966.

A panel of seven contractors with operating experience in on-stream liquid natural gas (LNG) plants answer questions on liquefaction at the first LNG conference sponsored by the Pacific Coast Gas Association. Of the four LNG plants now in operation, three have above-ground storage, two are designed for fully automatic operation, and all are designed for peak-shaving. Insurance rates show no significant changes when a company must cover an LNG plant. The plants are generally good public relations tools, indicating a company's progressive nature. In presentations before authorities, aspects such as economics, technology, and safety are important. Start-up problems at all four plants were remarkably few and minor in nature.

2387 APTIC NUMBER 20727

Arnold, Orlan M., Victor W. Hanson, Robert M. Jamison, Nicholas J. Panzica, and Emil Umbricht
METHOD AND APPARATUS FOR CLEANING CONTAMINATED GASES. (Ajem Labs., Inc., Livonia, Mich.) U. S. Pat. 3,475,881. 8p., Nov. 4, 1969. 9 refs. (Appl. April 8, 1968, 11 claims).

A method for removing pollutants from the gaseous discharge of a cupola furnace is described, which involves preconditioning a contaminated gas to remove a portion of the contaminants and to facilitate removal of those remaining at a subsequent stage by conventional gas washing techniques. This preconditioning includes saturating the contaminated gas with a water spray and condensing the resulting vapor. The effect of this saturation and condensation is a cooling of the gas, a collection of a certain portion of the contaminants, generally the larger size ones, and the formation of larger masses from the smaller size contaminants. Saturation is effected by means of an intense water spray through which the gaseous discharge is passed, and condensation is effected either by cooling of the gaseous discharge below the saturation temperature or the introduction of ambient air into the downcomer or a combination of the two. Afterburners may be introduced before the spray to burn out many of thy contaminants and simultaneously activate the remaining particles to cooperate with their removal.

2388 APTIC NUMBER 21292

Arras, K.
EVAPORATIVE COOLERS FOR ELECTROSTATIC PRECIPITATORS IN THE CEMENT INDUSTRY. (Verdampfungskuehler fuer Elektrofilter der

Zementidustrie). Text in German. Zement-Kalk-Gips (Wiesbaden), 59(3):106-112, March 1970. 5 refs. (Presented at a meeting of the Committee on Emissions of the German Cement Industry, Duesseldorf, Feb. 6, 1970.)

In the cement industry, waste gases must be conditioned (i.e., reducing the temperature of the waste gas and simultaneously increasing the moisture content) to reduce dust resistance. This measure is necessary to assure high collection efficiency of the electrostatic precipitator. Roughly 0.5 g water/cu m gas are needed to reduce the gas temperature by 1 C. For calculation of the volume of the evaporative cooler, the time required for evaporation of the injected droplets must be known. The equation by Gunz indicates that the evaporation time is proportional to the square of the maximum droplet diameter. Calculation of the volume as a function of the input and output conditions is more precise. There are four types of coolers: uniflow and counterflow coolers, with bottom to top or top to bottom flow. The cooler most commonly used in the cement industry is the uniflow type where the gas inlet and the water injection device is installed in the top. Of the various types of nozzles, the so called 'return pipe nozzle' has proved to be most advantageous because the droplet size does not increase when the throughput decreases. The water enters tangentially into a cylindrical chamber and cannot leave through the nozzle, since the diameter of the return pipe is larger than the nozzle opening. If the pipe cross section id changed by a simple shutter, so that the inner diameter of the water rotating in the chamber becomes smaller than the nozzle outlet, the water leaves through the outlet and is atomized. The quantity of water injected with such a nozzle can be controlled by changing the water quantity in the return pipe. The advantages and dissadvantages of conventional type nozzles and the possibilities of controlling the sprayed amount of water are likewise discussed. Examples of the arrangement of evaporative coolers behind heat-exchanger kilns with combined drying and grinding mills are presented.

2389 APTIC NUMBER 20770

Atsukawa, Masumi, Yoshihiko Nishimoto, and Kazuhiro Matsumoto
METHOD OF CONTACTING A GAS WITH A PARTICULATE SOLID. (Mitsubishi Heavy Industries, Ltd., Tokyo (Japan)) U. S. Pat. 3,485,014. 5p., Dec. 23, 1969. 7 refs. (Appl. July 2, 1968, 7 claims).

A cyclic method for establishing intimate contact between a particulate solid absorbent and a contaminated gas flow is described. Sulfur dioxide contaminated gas is divided into two parts, manganese oxide powder is mixed into one of the parts, and the two parts are combined. The solid to gas ratio is kept at a very high value which means that only a small portion of the solid particles actually participate in the purification of the gas and only a small portion need by regenerated. After passage through a contact zone, the absorbent is separated in a two-step operation in which the coarse particles and then the fine particles are separated, for example in a centrifugal-type separator and an electrostatic precipitator, respectively. All of the fine and some of the coarse particles are regenerated, and then the powder is recycled for contact with the gas. (Author abstract modified)

2390 APTIC NUMBER 20395

ZENITH STROMBERG EMISSION CARBURETTORS. Automobile Engr., 58(13): 530, Dec. 1968.

The production methods used in the manufacturing of emission carburettors were discussed. The quality of metering is dependent upon the maintenance of a proper relationship of the jet and needle at any given airflow, which pre-supposes precise alignment of the parts and consistency in maintaining the height of the air valve piston. These factors, together with the functional need to compensate for variation in the leak path past the air valve, call for very accurate control of the final boring operations in relation to the reference faces and locating diameters of the air valve body. Careful design of multi-step boring and facing cutter-heads with micro-bore carbide tipped cutting tools achieve the required standards of concentricity and squareness to the common axis. The critical dependence of the machining of the air-valve piston to guarantee needle-to-jet alignment called for extreme care in the choice of production method. A special-purpose machine was constructed to carry out all the machining operations, with the exception of the final finish-turning of the outer periphery and the end-face, on the piston diecasting. Variations attributed to operator error were obviated wherever possible by the use of automatic gauging techniques. Accurate performance of the carburettors, for emission control application, is guaranteed by automatically flow-checking the metering characteristics at four points selected to span the full range of operation. To achieve a quality assured product, in-process gauging was developed to a stage where the flow-test of the completed carburettor represents no more than a final screen. The degree of automation achieved represents a major step forward in manufacture and quality control.

2391 APTIC NUMBER 21124

Aymard, Cabinet
PROCESS AND APPARATUS FOR A TREATMENT INVOLVING GAS-POWDER CONTACT. (Procede et appareil pour un traitement avec contact gaz-poudre). (Mitsubishi Heavy Industries, Ltd., Tokyo (Japan)) French Pat. 87, 465. Dec. 5, 1966. (Appl. Jan. 27, 1966, 4 claims). Translated from French. 16p.

The process and apparatus described permit the suppression of waste gas (sulfur dioxide) by effectively dispersing in the gas a large quantity of solid particles of a material capable of absorbing the SO2. The absorbent is then extracted from the gaseous current, and is recycled. Before the entrance of the waste gas into the gas-solid contact column, part of the gaseous stream is diverted and mixed with the solid particles; this mixed stream is then projected into the principal gas stream, thus achieving uniform distribution of the particles throughout the entire gas supply. The gas-solid mixture is propelled into the contact column; the largest particles are separated from the gas in a centrifugal separator, and the finest particles, in a second separation stage,

are extracted by electrostatic precipitation, thus permitting the purified gas stream to be exhausted into the atmosphere. The separated solids (after regeneration, if necessary) are recycled into the system to absorb a fresh quantity of SO2, giving the advantages of a continuous treatment process.

2392 APTIC NUMBER 20417

Bakay, Tibor
PROCEDURE FOR DECOMPOSITION OF ZINC SULFITE OBTAINED DURING PURIFICATION OF FLUE GAS CONTAINING A SULFUROUS GAS. (Procede de decomposition du sulfite de zinc obtenu lors de l'epuration de gaz de fumees contenant du gaz sulfureux). Text in French. (Metallgesellschaft A. G., Frankfurt (W. Germany)) French Pat. 1,370,520. 2p., July 15, 1964. (Appl. Oct. 8, 1963, 4 claims.)

A procedure is presented for thermal decomposition of zinc sulfite, obtained during elimination of sulfurous gas from flue gases by the use of zinc oxide in aqueous suspension. Aqueous zinc sulfite is heated in two stages: in a pre-dryer at about 180 to 210 C, preferably at 190 C, for removal of water and in a subsequent drying apparatus at about 400 to 500 C, for removal of the sulfurous gas. The pre-dryer for heating the aqueous zinc sulfite is heated directly by the combustion gases; the subsequent drying apparatus is heated indirectly. The heating gases of the indirectly heated drying apparatus are used in the pre-dryer heated directly. A better utilization is obtained of the heat of combustion than heretofore. An example of such an installation and of its operation is given.

2393 APTIC NUMBER 20667

Bakker, Lubertus
GASEOUS WASTE INCINERATOR. (Air Preheater Co. Inc., Wellsville, N. Y.) U. S. Pat. 3,491,707. 4p., Jan 27, 1970. 4 refs. (Appl. Feb. 12, 1968, 10 claims).

A highly efficient fume incinerator arrangement is described for the complete elimination of combustible organic materials from airborne gases. The bottom of the combustion vessel is adapted to receive a series of tubes having slits or holes of adequate size to supply 80-120% of the theoretical amount of air needed for complete burning. Thus, as the carbon content increases with the type of material being burned, the amount of air required will accordingly increase too, but it will always be maintained by thermo-couple at from 80-120% of the stoichiometric amount required for combustion. The holes in tubes which provide the oxygen for combustion within the furnace are positioned to achieve optimum air circulation or at an angle of substantially 60 deg with the radius.

2394 APTIC NUMBER 21032

Bapseres, P.
INDUSTRIAL METHODS OF DESULPHURIZING SMOKE. (Recuperation du soufre a partir d'effluents gazeux sulfures humides). Text in French. Pollut. Atmos. (Paris), no. 45:1-15, Jan.-March 1970.

The industrial development of a country raises disturbing air pollution problems caused by the discharge to the atmosphere of such agents as sulfur compounds, fluoridized by-products, unburnt substances, nitrous vapors, and powder particles. Research carried out by the Societe Nationale des Petroles d'Aquitaine led to the development of a process which removes about 90% of sulfur dioxide from flue gas while producing 240 tons/day of sulfuric acid. The process is one of wet catalytic oxidation and involves the incineration to sulfur dioxide of hydrogen sulfide contained in residual gas leaving a Claus converter, the conversion of sulfur dioxide to sulfur trioxide on a solid catalyst in a mobile bed, the absorption of sulfur trioxide in the acid, and the concentration of the acid by gas-liquid contact, which is effected on a bed of Raschig rings.

2395 APTIC NUMBER 21091

Barbeito, Manuel S., Larry A. Taylor, and Reginald W. Seiders
MICROBIOLOGICAL EVALUATION OF A LARGE-VOLUME AIR INCINERATOR. Appl. Microbiol., 16(3):490-495, March 1968. 9 refs.

Two semiportable metal air incinerators, each with a capacity of 1,000 to 2,200 standard cu ft of air per min are described, for sterilizing infectious aerosols created for investigative work in a microbiological laboratory. Each unit has about the same air-handling capacity as a conventional air incinerator with a brick stack but costs only about one-third as much. The units are unique in that the burner housing and combustion chamber are air-tight and utilize a portion of the contaminated air stream to support combustion of fuel oil. Operation is continuous. High-concentration aerosols of liquid and dry suspensions of Bacillus subtilis var. niger spores and dry vegetative cells of Serratia marcescens were disseminated into the two incinerators to determine the conditions required for sterilization of contaminated air. Air-sterilization temperature varied with each incinerator, because of innate differences of fabrication, different spore concentrations, and use of one or two burners. With dry spores, no difference was noted in the sterilization temperature for the two incinerators. The design is adaptable to scaling up or down, which should make these new incinerators useful to universities, industrial laboratories, hospitals, or government installations with varying requirements. (Author abstract modified)

2396 APTIC NUMBER 20319

Barber, Everett M., John T. Brandenburg, and Richard A. Frost
CATALYTIC MUFFLER CONSTRUCTION FOR EXHAUST EMISSIONS CONTROL IN AN INTERNAL COMBUSTION ENGINE SYSTEM. (Texaco Inc., New York, N. Y.) U. S. Pat. 3,495,950. 6p., Feb. 17, 1970. 11 refs. (Appl. May 20, 1964, 2 claims).

An acoustic catalytic muffler is described for greatly reducing or

eliminating pollutant products from exhaust gases, and a method is provided for introducing additional air into the exhaust gases of an internal combustion engine for further reaction with the products of combustion. An engine driven pump provides additional air to the engine exhaust system. A back pressure regulating valve is included, functioning at the lower speeds above idle to maintain a pressure higher than the normal back pressure of an exhaust system. No warm-up period is required for operation of the disclosed automotive exhaust emissions control system, since proper temperatures for reaction between the exhaust products and additional air are obtained either at the exhaust ports or in the exhaust system adjacent to the catalytic muffler immediately upon starting of the internal combustion engine.

2397 APTIC NUMBER 20960

Barnes, Thomas M., Albert O. Hoffman, and H. W. Lownie, Jr.
EVALUATION OF PROCESS ALTERNATIVES TO IMPROVE CONTROL OF AIR POLLUTION FROM PRODUCTION OF COKE. (FINAL REPORT). Battelle Memorial Inst., Columbus, Ohio, Columbus Labs., Contract PH 22-68-65, 149p., Jan. 31, 1970. 90 refs.
CFSTI: PB 189266

The findings and recommendations from a 6-month study of air-pollution control in the manufacture of blast-furnace coke are presented. The provision of new or improved equipment for control of emissions from conventional coke ovens, and the development of new, potentially cleaner processes for conversion of coal into blast-furnace coke were investigated. The emissions and control methods for the various processes in conventional coking are discussed (charging of coal to the slot ovens, underfiring the slot ovens with coke-over gas, sealing of slot ovens during early stages, discharging of newly produced coke, and quenching of hot coke). Large investments in new equipment can make a contribution to air quality at and near conventional coke ovens; but by their very nature, such ovens will always be emission sources to some degree. There are no generally accepted devices or procedures for measuring and evaluating emissions and emission controls for coke ovens. It is urged that research instruments and procedures be developed for measuring emissions, since they are needed to permit quantitative evaluation of the effectiveness of control processes and equipment. Several unconventional coking processes that are in the pilot-plant and demonstration stages were examined (fluidized bed operations, forming balls in a hot retort, hot and cold briquetting, curing of briquettes, final coking in gas-fired vertical-shaft furnaces, intermediate and final coking in units that recirculate hot sand, traveling-grate cokes, rotary hearth cokers, and batch-type sole-flue ovens). It is concluded that these processes are more amenable than slot-oven coking to the control of air-polluting emissions. Continued development and industrial trial of these processes should be encouraged. One important contribution would be research conducted to improve understanding of coke properties affecting performance in a blast furnace.

2398 APTIC NUMBER 20931

Barth, Walter

FUNDAMENTAL INVESTIGATIONS ON THE CLEANING CAPACITY OF WATER DROPLETS. (Grundlegend Untersuchungen ueber die Reinigungsleistung v Wassertropfen). Staub (Duesseldorf), vol. 19:175-180, MAY 1959. 12 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 21p.

With wet cleaning, the dust-laden gas is mixed with water by some method. In many cases, the water is atomized and injected into a gas flow. These processes are of a hydrodynamic nature, and can be theoretically examined. For a fundamental analysis of the processes, an analytical approach is needed. The cleaning capacity (in the form of the dimensionless parameter as a function of the droplet size, at a gas velocity of 20 m/sec, and for various particle sizes of the dust carried along) is graphically shown. The data indicate that there are certain droplet sizes with which an optimum cleaning capacity can be achieved. With very large and very small droplets, the cleaning capacity becomes zero. The optimum droplet size shifts to increasingly larger diameters with increasing particle size of the dust. The influence of the gas velocity and the droplet size on the cleaning capacity for a certain size of dust particles is illustrated. The collection efficiency increases considerably with increasing gas velocity for both large and small droplets. The improvement in percent cleaning capacity achieved through increasing the gas velocity is much higher for fine dusts than for coarse dust particles. Some practical conclusions for the construction of wet cleaning systems are given.

2399 APTIC NUMBER 20325

Barthel, Fay E.
DUST COLLECTOR FOR DRILLING EQUIPMENT. (Assignee not given.) U. S. Pat. 3,499,181. 3p., March 10, 1970. 4 refs. (Appl. Dec. 21, 1967, 1 claim).

An attachment for drilling equipment is described for deflecting away from the immediate area materials such as dust and other fine particles that collect from the drilling action. It comprises a generally rectangular structure consisting of two separable half sections hinged along adjacent edges; fastening means for connecting the opposite edges to form a boxlike enclosure having an open bottom and an open top; and inwardly extending spaced flanges surrounding the top and bottom openings. There is an object defining an opening in the side wall of one half section adapted for the reception of a vacuum house and a felt sheet overlying the top opening of each half section; the sections have adjacent edges when the structure is closed between which a drill is extended. Legs come from the under side of each section, and coil springs which abut the surface to be drilled extend from the extremity of each leg.

2400 APTIC NUMBER 21294

Bauch, Heinrich and Harry Burchard
ATTEMPTS FOR IMPROVING STRONGLY SMELLING OR TOXIC EFFLUENTS BY OZONE. (Ueber Versuche, stark riechende oder schaedliche Abwaesser mit Ozon zu verbessern). Text in German. Wasser Luft Betrieb, 14(8):134-137, 1970.

The influence of ozone on waste water from the lacquer and paint industry containing alcohols, esters, ketones, aldehydes, benzene, xylol, toluol, phenols, thioesters, chlorinated hydrocarbons, fats, and oils was studied. The waste water was subjected to preliminary treatment. The pH was reduced to between 2 and 4 with sulfuric acid; 0.05 to 0.1 g iron and/or aluminum was added. Calcium hydroxide was added until a pH of 6.5 to 8 was obtained. Most metals, organic solvents, oils, and resins were removed. The phenols, esters, alcohols, etc. were not affected by this treatment. Addition of ozone (ozonized air, or ozonized oxygen) markedly diminished the $KMnO_4$ demand. Odors were strikingly reduced. But not all organic substances were oxidized. Acids, chlorinated hydrocarbons, pyridine, and saturated paraffins were hardly attacked by ozone. Preliminary treatment of the waste water with chlorine reduced the ozone consumption.

2401 APTIC NUMBER 20665

Baudry, J.
STUDY OF PROCEDURES PERMITTING THE REDUCTION OF POLLUTANT EMISSIONS BY THE IMPROVEMENT OF COMBUSTION (CONTROLLED IGNITION MOTORS). (La recherche de procedes permettant de reduire les emissions de polluants par action sur la combustion (moteur a allumage commande)). Text in French. Rev. Inst. Franc. Petrole Ann. Combust. Liquides (Paris), 24(12):1493-1506, Dec. 1969. 7 refs. (Presented at the Congres Visita, May 20, 1968.)

Improvement of combustion as a means of reducing air pollution is examined from the literature and on the basis of research data obtained by the Combustion Department of the Institut Francais du Petrole. Among the problems posed in securing perfect combustion are those of carburetion and distribution. Most conventional carburetors are not sensitive to changes in motor speed, air temperature, and pressure. The formation of carbon monoxide, nitrogen oxides, and unburned hydrocarbons is discussed. Suggestions for improvement center around the type of fuel used, the shape of the combustion chamber, stratification of the air-gas mixture, ignition characteristics, and reduction of the fuel supply during deceleration. One of the major defects of the present-day internal combustion motor is its relatively poor performance when operating at less than a full load.

2402 APTIC NUMBER 21611

Bechtol, Maurice
TWIN TANK IN-GROUND LNG PLANT COMPLETED BY TENNESSEE GAS. Pipeline News, vol. 39:27-30, Sept. 1967.

The planning, design, and construction of a liquefied natural gas storage facility, completed in 1968, are presented. The facility consists of a liquefaction unit, a regasifier, and two inground storage reservoirs of 135 foot diameter and 172 foot depth. The tanks utilize the natural granite of the bedrock as containing walls; a glacial till, frozen by the stored gas and retained by a concrete wall three feet thick, serves as the gas barrier from the bedrock to the surface. The concrete wall also serves as a support for the double shelled steel roof on each tank. The facility provides storage and peaking service to 18 utility companies in the area of Hopkinton, Mass., where it was constructed. Capacity of the facility is 248 million cu ft of gas per day.

2403 APTIC NUMBER 20321

Beck, Paul R.
AIR POLLUTION INHIBITING MEANS IN THE FORM OF A FUEL RECIRCULATING APPARATUS FOR AN INTERNAL COMBUSTION ENGINE. (Harry A. Bradshaw) U. S. Pat. 3,492,980. 5p., Feb. 3, 1970. 9 refs. (Appl. Nov. 13, 1967, 5 claims).

An air pollution inhibiting system is contemplated for internal combustion engines, comprising a tank operatively connected to the intake manifold of the engine through a vacuum line in which there is interposed a carbon trap. The tank also has one end connected to the engine tail pipe and its other end connected to the engine exhaust manifold through an exhaust pipe in which the usual muffler is interposed. Exhaust gases from the pipe enter the tank and are directed into the large end of a funnel within the tank; the small end of the funnel is in direct sealed communication with the vacuum line. An adjustable shutter valve across the mouth of the funnel controls the percentage of exhaust gases which may be returned to the intake manifold; the remaining exhaust gases by-passes the funnel and go directly through the tank to the tail pipe. (Author abstract)

2404 APTIC NUMBER 20308

Berg, T. G. Owe
METHOD AND APPARATUS FOR REMOVING PARTICULATES FROM FLOWING GASES. (Assignee not given.) U. S. Pat. 3,496,701. 4p., Feb. 24, 1970. 11 refs. (Appl. Dec. 13, 1967, 8 claims).

Particulates are removed from gases flowing through a duct by concentrating the particulates within a narrow region of the duct and treating the gas flowing in this region. The concentration of the particulates within a narrow region is accomplished by a non-uniform alternating electric field within the duct. In the event that the natural charge on the particulates does not suffice, charging can be effected by means of a corona discharge or any other known device for charging particles. Although a configuration of four electrodes spaced at 90 deg intervals around a duct in conjunction with a transformer and an A. C. source has been shown for generating a non-uniform alternating electric field, it is obvious that other well known arrangements for accomplishing the same result may be used. (Author abstract modified)

2405 APTIC NUMBER 21699

Bergmann, Helmut and Rudolph Stenzel
BAG FILTERS FOR DUST COLLECTION. Schlauchfilter zur Staubabscheidung). Text in German. (Intensiv-Filter GmbH,

Langenberg (Germany)) Swiss Pat. 452 327. 3p. Feb. 29, 1968. (Appl. Feb. 17, 1967, 2 claims).

A bag filter is described with an inlet for the dirty gas, an outlet for the cleaned gas, and elastic suspension of the filter bags. Filter bags are cleaned by a shaking device and an air stream. The invention pertains to the special mounting of the bags on an iron bar which rests on springs. The bar is simultaneously the shaking frame. It is connected, via a central vertical bar, piercing the filter cashing on top, with a pendulum shaker. The valve flap of the cleaned gas valve and that of the scavenging valve in the scavenging air duct are connected with each other and are controlled by a common drive, e.g., by a pneumatic cylindrical piston actuator. When the clean air valve is open, the scavenging valve is closed and vice versa. Both the shaker and the actuator are controlled by a program switch.

2406 APTIC NUMBER 21578

Berlie, Elmer H.
NATURAL GAS PROCESSING. SAFER PROCESSING OF H2S-BEARING GAS. Hydrocarbon Process. Petrol. Refiner, 42(4):115-123, April 1963. 9 refs.

A guide to handling hydrogen sulfide, a toxic contaminant encountered more and more in the gas processing industry, is provided. To manage these gases safely, processors need to design air breathing systems, select and apply related breathing equipment, and provide rescue apparatus. Training and maintenance programs are also needed to ensure effective use of this equipment. Exposure to H2S above 500 ppm can lead to unconsciousness and death. The victim's air passage should be opened by tilting the head back as far as it will go. to restore breathing employ artificial respiration, and, to restore circulation, a closed chest heart massage should be applied. Central, isolated, or portable air breathing systems can be used in a natural gas processing plant depending on the extent of area, the nature of the processes involved, and economic considerations. Air line and self-contained demand masks can be applied safely in all types of atmospheres injurious to the eyes or respiratory system. Mechanical, oxygen fed resuscitation equipment is a necessity where H2S is processed. Detector and alarm systems for use in plants where H2S is processed are also discussed.

2407 APTIC NUMBER 20779

Berman, Paul A.
MOISTURE CONTENT AND COMBUSTION PRODUCT REMOVAL APPARATUS FOR EXHAUST GASES. (Westinghouse Electric Corp., Pittsburgh, Pa.) U. S. Pat. 3,473,298. 6p., Oct. 21, 1969. 7 refs. (Appl. Dec. 26, 1967, 4 claims).

An apparatus is described for recovering and utilizing water introduced into a steam injection power plant, and for removing moisture content and combustion products from exhaust gases before they are admitted to the atmosphere. This is accomplished by a recirculating water system in which the water initially is employed to directly contact and chill the exhaust gases in a spray chamber to effect removal of solid particle and water soluble contaminants. The water is then directed through a condenser for subsequently condensing the remaining vapor entrained in the gases, and to heat exchangers in an air mixing region in which ambient air is heated and added to the gases before they are admitted to the atmosphere, thereby providing a stack effluent of very low relative humidity. The temperature of the water is raised by its contact with the exhaust gases so that, when circulated through the heat exchangers, it functions to heat the ambient air with the consequent cooling of the water for return to the condenser and spray chamber.

2408 APTIC NUMBER 21605

Besnard, Jean and Robert Vincent
SOME RESULTS OF EXPERIMENTAL RESEARCH INTO THE STORAGE OF LIQUEFIED NATURAL GAS. (Quelques resultats des recherches experimentales sur le stockage du gaz naturel liquefie). Text in French. Compt. Rend. Congr. Ind. Gaz, vol. 77:331-345, 1960.

The preliminary results from a study of the problem of storing liquefied natural gas are reported; the chief results obtained from the laboratory tests are given with respect to storage material quality, traction, compression, and tensile strength. These permitted checking the characteristics of the insulators intended for low temperature, and allowed them to be ascertained in cases where they were not known with any degree of certainty. The various safety factors relating to the storage of liquid methane were also stipulated.

2409 APTIC NUMBER 20768

Bettega, Bruno
ANTI-AIR POLLUTION DEVICE FOR INTERNAL COMBUSTION ENGINES. (Assignee not given.) U. S. Pat. 3,477,277. 4p., Nov. 11, 1969. 5 refs. (Appl. March 5, 1968, 14 claims).

A method and device for removing carbon monoxide and particulate matter from the exhaust gas of internal combustion engines are described. The muffler is modified to receive the exhaust gas while it is still at a high temperature, while it is also a catalyst chamber in which CO reacts with oxygen to form carbon dioxide. Cupric oxide is used as the catalyst. A limited amount of air is admitted to the upstream end of the muffler to supply the oxygen without diluting the exhaust so much as to cool it below the critical temperature of the catalytic reaction. Water vapor in the exhaust is condensed, and the water is trapped and sprayed into the remainder of the exhaust gases to wash out the particulate matter. (Author abstract modified)

2410 APTIC NUMBER 21313

Bieber, K. H.
SUCCESSFUL OPERATION OF WET SOOT BLOWERS. (Betriebliche Bewaehrung von Wasserrussblaesern). Text in German. Mitt. Ver. Grosskesselbesitzer, 50(2):83-88, April 1970. 1 ref.

Wet soot blowers were installed in the boilers of a power plant to prevent heavy soiling on the flue gas side. Condensate from the turbines was used as cleaning agent. The blowers were installed in two rows in the lower section of the first flue. The effective diameter of the front and rear blowers was adjusted to 8 m; that of the side blowers, to 5 m. The water consumption per blower was 0.25 cu m. At first the blowers were used three times a day and later, only once a day. The heating surfaces within the reach of the blowers in the first flue could be kept 90% clean. Steam blowers were installed between the first and second flue. A single application of them per day sufficed to prevent fly ash incrustations. Test of the duct material revealed no adverse effects caused by the blowers. One blowing operation from turning on to turning off the blower lasted 20 min. The pure blowing time was 12 min. The blowers failed several times because of deformation by falling incrustations. After operation of the blowers in the first flue, heavy soiling occurred in the second flue so that ten steam blowers had to be installed.

2411 APTIC NUMBER 20483

Beinstock, D., H. C. Kurtzrock, E. R. Bauer, Jr., and J. H. Field
REMOVAL OF HYDROCARBONS AND CARBON MONOXIDE FROM AUTOMOTIVE EXHAUST, USING A PROMOTED URANIUM CATALYST. Bureau of Mines, Washington, D. C., Rept. of Investigations 6323, 18p., 1963. 8 refs.

To remove hydrocarbons and carbon monoxide in automotive exhaust by oxidation, a catalyst of 4.2% U3O8, 1.7% Cr2O3, and 1.7% CuO supported on 1/8-inch gamma-alumina spheres was tested in a reactor in place of the muffler of a 1/2-ton truck. With a nonleaded gasoline during a 525-mi test interval, practically complete conversion of hydrocarbons and CO (98 and 100% respectively) was obtained during the idling portion of the cycle after warmup, and fairly high conversions of the hydrocarbons were obtained at cruising speeds of 30 mph. Carbon monoxide produced by the engine during the 30-mph cruising period was less than 0.3%. At this low concentration, CO was not oxidized appreciably by the catalyst; however, this quantity emitted to the open atmosphere does not have a significant pollutant effect. In operating the engine under idle conditions from a cold start, the temperature of the exhaust is insufficient to start and sustain catalytic activity. However, during the driving cycle, the temperature of the exhaust leaving the engine is sufficient to maintain high-catalytic activity for the oxidation of hydrocarbons and CO. After reaching operating temperatures (more than 400 C), the catalytic reactor generates enough heat to operate effectively at idle conditions, even for extended periods. Tests with leaded gasolines showed high initial conversions; but after 1300 mi, these decreased by 23% for hydrocarbons and 25% for CO. (Author conclusions modified)

2412 APTIC NUMBER 20663

Bienstock, D., J. H. Field, and H. E. Benson
SULFUR DIOXIDE IN ATMOSPHERIC POLLUTION, AND METHODS OF CONTROL. Nat'l Research Council Pub. 652, p. 54-62, 1959. 27 refs.

The undesirability of sulfur dioxide in the atmosphere has been recognized because of its highly irritating effect on the respiratory system, its adverse effect on plant life in concentrations as low as 0.3 ppm, and its attack on many metals, fabrics, and building materials. Based on a coal usage of 350,000,000 tons in 1955 and an average sulfur concentration of 1.9%, about 6,600,000 tons of sulfur or twice this amount of sulfur dioxide was emitted from this fuel source. Extensive industrial application of any process for removal of SO2 would result in the formation of tremendous quantities of sulfur products that would ultimately affect the market prices of sulfur in any of its forms; and the problem of storage and handling, marketability, and the selling price of the sulfur product will have considerable influence on the acceptability of a purification process. Several methods are available in the direct reduction of the sulfur content of coal prior to combustion, including mechanical cleaning of coal, partial gasification and carbonization to form a low-sulfur char, and complete gasification with a subsequent removal of the sulfur in the form of hydrogen sulfide. For removal of sulfur dioxide after combustion, consideration is directed toward the development of hot absorption processes.

2413 APTIC NUMBER 21047

Blakey, P. B.
A LOGICAL APPROACH TO THE EVALUATION OF DUST AND FUME CONTROL PROBLEMS. Filtration Separation (Purley), 7(3):319-324, 327, 329, 330, May/June 1970. 16 refs. (Presented at Filtration Society Conference on Choosing the Right Equipment for Dust Control and Air Cleaning, London, England, Sept. 23-25, 1969.)

Since dust and fume control is still an empirical science, an effort is made to produce a logical assessment of the criteria involved in chart form which, if followed, will lead to a successful conclusion. The chart sets out the logical step-by-step approach to the problem from the initial factors influencing the need to install dust and fume equipment through a consideration of the contaminant of the pollutant at source, removal from the gas stream, followed by a consideration of competitive tenders to a final installation, its ultimate assessment, and acceptance. The requirements implicit in two acts of Parliament, the Alkali Act and the Clean Air Act of 1956, are considered. (Author abstract modified)

2414 APTIC NUMBER 21583

Blears, Dennis Rybird
CONTINENTAL LARGE-SCALE STORAGE INSTALLATIONS. Inst. Gas Eng. J (London), vol. 6:311-332, May 1966. 34 refs.

The large-scale storage of liquid natural gas (LNG) in overground and underground installations is discussed. The

main West European storages are individually reviewed in terms of their development, problems encountered, and broad economic aspects. Major storage developments in Europe have occurred in the field of aquifers. The cost of gas storage in aquifers can vary widely, being dependent on the location, size, and characteristics of the structure. When suitable, an aquifer can offer the most economic solution for normal seasonal variations in gas demands, but cannot be exploited as quickly as man-made storages or production plants. Salt cavities and clay tunnels offer potential storage possibilities. Large-scale storages are difficult to compare in strict financial terms. There are many factors to be considered for a particular location.

2415 APTIC NUMBER 20288

Bois, Anthelme
EXHAUST GAS PURIFYING DEVICES. (Automobiles M. Berliet, Lyon, (France)) U. S. Pat. 3,499,269. 3p., March 10, 1970. 12 refs. (Appl. March 18, 1968, 1 claim).

A device for purifying exhaust gases which contain solid particles from diesel engines is described. The invention consists of a filter of kaolin wool which is capable of retaining the solid components of the exhaust gases. The filter is situated so close to the engine that the exhaust gas temperature ignites the retained solids, such as soot, unless the engine is operated under full-load conditions. A safety valve allows the gas to by-pass the filter when a predetermined exhaust pressure value is attained.

2416 APTIC NUMBER 20661

Borst, William B. Jr.
METHOD FOR THE CONVERSION OF HYDROCARBONS. (Universal Oil Products Co., Des Plaines, Ill.) U. S. Pat. 3,489,674. 6p., Jan. 13, 1970. 3 refs. (Appl. May 29, 1968, 7 claims).

A method is described for the hydrogenation of relatively high boiling sulfur-containing hydrocarbons (1100 F) by cataltyic exothermic reaction with a normally gaseous reactant, which relates specifically to hydrocracking black oil hydrocarbons by an improved manner of quenching the hydrocracking reaction. It comprises the introduction of feed hydrocarbons into a catalytic reaction zone maintained under conversion conditions, including the presence of hydrogen gas. The total effluent is passed from the catalytic zone into a first separation zone under conditions sufficient to produce a first vapor stream. A quench stream is introduced directly into the downstream side of the reaction zone in an amount sufficient to maintain a predetermined temperature of the first vapor stream. The first vapor stream is cooled to within 50-150 F and separated in a second reaction zone under conditions sufficient to provide a second vapor stream comprising hydrogen and a second liquid stream containing converted hydrocarbons. At least a portion of the second vapor stream is passed into indirect heat exchange with a portion of the first liquid stream, thereby cooling the liquid portion and heating the gaseous portion; the cooled portion is passed as quench into the downstream side, and the heated gaseous portion is returned to the reaction zone. The present invention is distinctly applicable to the hydrocracking reaction which is utilized by the petroleum refining art to convert relatively heavy carbonaceous material into lower boiling hydrocarbon products. In other instances, the hydrocracking reaction is used for the production of liquefied petroleum gas.

2417 APTIC NUMBER 20781

Borst, William B. Jr.
METHOD FOR THE CONVERSION OF HYDROCARBONS. (Universal Oil Products Co., Des Plaines, Ill.) U. S. Pat. 3,475,324. 6p., Oct. 28, 1969. 4 refs. (Appl. March 8, 1967, 9 claims).

A method for hydrocracking relatively high boiling hydrocarbons (1100 F) is described. Feed hydrocarbons are introduced into a catalytic reaction zone maintained under conversion conditions including the presence of hydrogen gas. The reactor effluent is quenched with a specific vaporous stream which had been previously separated from the reaction zone effluent. The amount of vapor quench is responsive to the measurement of the temperature of the vapor stream out of the high pressure separator such that a predetermined temperature (below about 775 F) is maintained in the vapor stream. Hydrocarbon products of reduced sulfur content are subsequently recovered. (Author abstract modified)

2418 APTIC NUMBER 21558

Bradford, W. L.
UNION, MARATHON CONSIDER ALASKAN GAS LIQUEFACTION. Hydrocarbon Process Petrol. Refiner, 42(4):129-132, April 1963.

Liquefaction of Alaskan natural gas is being considered by two U. S. oil companies for shipment to markets in the Pacific, in particular to a proposed Japanese liquid storage and regasification plant. The Alaskan facility will be designed with a capacity sufficient to meet the gas deliveries on an average-day basis, the boiloff loss encountered on board ship and from Alaskan storage as well as an additional amount to permit 15 days of plant shut-down each year. This will add up to a plant capacity of approximately 42 MMcfd. Dehydrated gas will be received at the plant at 600 psi and 40 F, passed through scrubbers for solid removal, dehydrated further in solid dessicant dehydrators, and then cooled and condensed under pressure in a cascade system using propane and ethylene as refrigerants. Compression requirements for process pressures and temperatures will be 450 bhp per MMcfd liquefied. Liquefied methane at -258 F will be pumped continuously to storage tanks prior to transfer to ship by a high capacity loading pump. About 15,500 tons of liquid methane can be transported to Japan in a 37,500-dwt tanker. This is equivalent to about 35 MMcfd delivered to market, with approximately 290,000 barrels of storage required in Alaska. On the ship, the liquid methane will be stored in tanks having an inner shell or membrane of stainless steel and surrounded by self-supporting insulation. An outer steel shell will protect the insulation from damage by mechanical strain or by penetration of moisture.

2419 APTIC NUMBER 20616

Brandt, Herbert
STABLE BACK DISCHARGE IN ELECTROSTATIC PRECIPITATORS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(8):21-22, Aug. 1969. 1 ref.

A study of 14 stage precipitators for fly ash removal from steam boiler furnaces indicated that the voltage peak in the 42 high-voltage fields of the precipitators varied from about 300 to 1500 mA at fluctuating current intensities. Though back discharge set in at the voltage peak and increased with rising current, the process was obviously stable and did not cause a substantial reduction in efficiency. Neither did it correspond to theories that assume that electric breakdown in the dust layers reverse the ionization effect on the dust quantities and drive them back to the discharge electrodes. To understand back discharge phenomena, the process was simulated in laboratory experiments in which the dust layer was replaced by nylon fabric above Teflon foils. Blue light cones appeared between approximately 5% of the discharge electrode points and the foil. No flashovers occurred in the fabric or foil. When flashovers were induced by adjusting the voltage and making small holes in the insulating layer, they occurred not in the light cone but adjacent to it and at more distant electrodes. A photograph clearly indicated the luminescence of the excited ions; the space charge at the light cone was greater because of the intense ionization. The results thus indicate why flashovers from point wires occur at higher voltages than from radial or strip wires.

2420 APTIC NUMBER 21211

Brandt, Herbert
WET-TYPE DUST PRECIPITATORS. (Assignee not given.) U. S. Pat. 3,481,115. 7p., Dec. 2, 1969. 4 refs. (Appl. May 7, 1968, 5 claims).

A method is described to increase the circulating velocity of the less polluted water and at the same time to substantially inhibit circulation of the more extensively polluted water proportion in a wet dust precipitator. The less polluted water together with the fresh make-up water is separated, by means of walls in the first chamber into which the crude gases enter, from the more extensively polluted water in the settling chamber. An air lift pump is constructed as a pocket which extends to below the water surface of the first chamber and has above the water surface only a low entry height for a certain amount of gas whose buoyancy is the up-thrust and entrained water effects delivery. Water returns from the contact stratum, polluted by the absorption of dust, through overflow troughs which surround the contact bed; it then passes into the second chamber which serves as a settling place. The water content of the settling chamber is undisturbed on the gas entry side by virture of its separation from the gas entry chamber, while its construction as a perforated wall on that side which is opposite to the return flow permits the return of water from the settling chamber into the gas entry chamber. Sludge delivery is effected by a scraper belt which is provided with vertical bulkheads which are so arranged that they separate the return flow of the water from the settling chamber to the gas entry chamber from the lower part of the settling chamber in order to assist settling of the sludge.

2421 APTIC NUMBER 20258

Brink, David L., Jerome F. Thomas, and Kay H. Jones
MALODOROUS PRODUCTS FROM THE COMBUSTION OF KRAFT BLACK LIQUOR. III. A RATIONALE FOR CONTROLLING ODORS. Tappi, 53(5):837-843, May 1970. 12 refs. (Presented, in part, at the Technical Association of the Pulp and Paper Industry, Annual Meeting, New York, Feb. 1967.)

Studies of batch and steady-state pyrolysis in kraft black liquor combustion are summarized and pertinent differences are discussed in a series of experiments covering a temperature range from 400 to 1135 C. A many-fold increase in the volume of uncondensed gases formed in the higher temperature ranges, and the composition of these gases, are presented as evidence for the occurrence of extensive gasification of carbonaceous residues by the steam-char reaction under steady-state conditions. This reaction is significantly reduced under batch conditions. In the lower temperature ranges, a high percentage of the sulfur present in the black liquor is converted to an array of at least 57 different sulfur-containing malodorous products. Under steady-state conditions, these products are decomposed as temperature is increased with only small amounts remaining above 1000 C. A summation of the calorific values of the major steady-state pyrolysis products isolated from black liquor solids shows the overall system to be endothermic. The significance of the study with respect to furnace operation and associated problems, especially odor emission and its abatement, are discussed, and a conceptual basis for designing a pyrolysis-combustion system employing multistage pyrolysis is suggested.

2422 APTIC NUMBER 21435

Brion, Jacques, Michel Cousin, Wulf Talejkinski, and Andre Volk
GAS FILTERING INSTALLATION. (Commissariat a l'Energie Atomique, Paris (France)) U. S. Pat. 3,479,800. 10p., Nov. 25, 1969. 3 refs. (Appl. July 24, 1967, 10 claims).

An installation is described which is very suitable for filtering hot gases including the smoke from waste incinerators, since not only can it provide rapid and completely safe cleaning of the filters whenever necessary, but also it can use filter elements in the form of porous tubes lined with a fibrous deposit and is able to withstand heat very well. The installation comprises a casing, porous filtering tubes disposed in side-by-side relationship, a supply line communicating with the interior of the tubes, and an exit line with the outside of the tubes. A number of tubular probes are located above the filtered tubes, rigidly interconnected and connected to a suction system, with apparatus for moving them from a withdrawn position above the tubes during filtering and a position in the tubes for sucking deposits away from the inner walls of the tubes. A unit for

spraying a fibrous lining into the cleaned and stripped porous tubes is also included.

2423 APTIC NUMBER 20732

Brose, Harlan P.
CATALYTIC BURNER. (United Aircraft Corp., East Hartford, Conn.) U. S. Pat. 3,479,144. 3p., Nov. 18, 1969. 1 ref. (Appl. Sept. 22, 1964, 10 claims).

The catalytic burner described minimizes heat loss conduction and/or radiation to the surrounding environment, e.g., spacecraft atmospheres, and requires extremely low power. This is accomplished by imbedding a regenerative heat exchanger, heater and catalyst bed in a super insulator, providing maximum length of heat exchange in a given space, and routing the contaminated airstream in a particular manner through the catalytic burner. Air first enters the heat exchanger where it is heated indirectly by the hot air emerging from the catalytic burner. It then passes through an extended inlet tube and is heated as it impinges on the inside of a heater retainer. After striking the heat retainer, the inlet air passes through the catalytic bed where gases such as carbon monoxide, hydrogen, and methane are oxidized to carbon dioxide and water. The product air then passes out through the exit tube and coil of the heat exchanger, where it is cooled to reduce heat loss by transferring heat to the inlet air in the coil. A preferred procedure uses rhodium-alumina as the catalyst.

2424 APTIC NUMBER 20609

Brownson, D. A., R. S. Johnson, and A. Candelise
A PROGRESS REPORT ON MANAIROX-MANIFOLD AIR OXIDATION OF EXHAUST GAS. Preprint, Society of Automotive Engineers, Inc., New York, 16p., 1962. 8 refs. (Presented at the National Automobile Week Congress, Detroit, Mich., March 12-16, 1962, Paper 486M.)

Manifold air oxidation was investigated as a method of reducing exhaust gas hydrocarbons and carbon monoxide. For simple manifold oxidation systems consisting of an engine-driven air pump and tubing to distribute the air to individual exhaust ports, tube location and injection air flow rate were important design variables. Locating the tube discharge closer to the exhaust valve increased oxidation. The optimum air flow rates for maximum hydrocarbon oxidation were lower than those for maximum carbon monoxide oxidation at the same engine conditions. For most engine conditions, carbon monoxide oxidation was limited by pump capacity, and optimum air flows were not reached. In road tests of several simple manifold air oxidation systems, modest reductions in both hydrocarbon and carbon monoxide emissions were achieved. Higher initial hydrocarbon concentrations were accompanied by greater percentage hydrocarbon reductions. Greater emission reductions were obtained by combining the manifold air oxidation systems with other reduction methods. Combination of the system and lean carburetion gave nearly additive hydrocarbon and carbon monoxide reductions. Addition of retarded spark timing to this combination gave still further reductions. Of the possible methods of improving the manifold air oxidation systems, increasing the temperature of the injected air appears to be the most promising.

2425 APTIC NUMBER 21341

Buchwald, Herbert
ACTIVATED SILICA GEL AS AN ADSORBENT FOR ATMOSPHERIC CONTAMINANTS. Occupational Health Rev. (Ottawa), 17(4):14-18, 1965. 17 refs.

Some of the factors involved in the adsorption and desorption of atmospheric contaminants with respect to silica gel are discussed, as well as its relative merits as a collecting media. Quality and size range are mentioned, and a treatment is recommended if impurities are suspected. A single small U-tube containing up to 10 g of adsorbent is sufficient for complete analytical recovery of many contaminants from a wide range of atmospheric concentrations. Prepacked U-tubes are portable and can be prepared several days in advance, provided they are properly sealed. A compact U-tube fitted with a suitable clip can be used as a personal breathing zone sampler in conjunction with one of the pocket size pump units available. Studies on the adsorption of such common solvents as acetone, benzene and its homologues, and some halogenated hydrocarbons are presented. (Author abstract modified)

2426 APTIC NUMBER 20437

Burchsted, C. A. and A. B. Fuller
DESIGN, CONSTRUCTION, AND TESTING OF HIGH-EFFICIENCY AIR FILTRATION SYSTEMS FOR NUCLEAR APPLICATION. Oak Ridge National Lab., Tenn., Nuclear Safety Information Center, Contract W-7405-eng-26, 193p., Jan. 1970. 164 refs.
CFSTI: ORNL NSIC-65

In order to review current practices and to define the problems in operating, maintaining, and controlling contamination release from very high-efficiency air-cleaning systems, visits were made to AEC production reactors, commercial power reactors, laboratories, radiochemical plants, reactor fuel manufacturers, clean rooms, equipment manufacturers, and one chemical-biological warfare installation. Operational considerations include filter change frequency, building supply filters, prefilters, operation to high pressure drop, and underrating, while environmental factors depend on the nature of the contaminants to be removed (radioactivity, toxicity, corrosivity) and on heat, moisture, and other conditions that can affect the performance or life of system components. Consideration must be given to damage of the filter system from shock, vibration, or fire; to design and arrangement of ducts and housings to alleviate these conditions; to the possibility of a power outage and means of switching to an alternate power system; and to methods of controlling the exhaust system during failure conditions. Factors that largely influence the cost of maintenance are the frequency and ease of replacing filters. In addition to the filters, important parts of the ventilating system are the fans, ducts, dampers, and instruments, which must be given design considerations. When space permits, round duct is preferred to rectangular duct because it is stronger and less likely to collapse under external pressure, is more economical of materials, provides

more uniform air flow velocities, is easier to fabricate and erect, is easier to join and seal, and is usually cheaper. Other problem areas are ventilating system control and instrumentation, air sampling, and air intakes and stacks. Characteristics, construction, and limitations of the components are reviewed; types of filter systems, and gloved box filtration is described. Filters and adsorbers are tested, and the basic design and construction requirements are given for remotely maintained and reactor post-accident cleanup filtration systems.

2427 APTIC NUMBER 20744

Burdock, Joseph L. and Angelo J. Cioffi
APPARATUS FOR REMOVING SUSPENDED PARTICLES FROM GASES. (Universal Oil Products Co., Des Plaines, Ill.) U. S. Pat. 3,483,678. 4p., Dec. 16, 1969. 14 refs. (Appl. May 29, 1967, 2 claims).

A device for removing slugs and fine droplets of suspended liquids, with or without solids, from a natural gas stream is described. The main flood of liquid reaching the separator unit is intercepted and removed before it can reach the multitube separators to avoid flooding them. A large perforated tube extends from the inlet to the separator casing, the lower end of which is baffled or closed, except for some openings which extend up into the vertical part of the tube. The liquid in the gas stream impinges on the bottom of the tube and flows out through the openings without frothing or without being sprayed outwardly to cause mist. The gas, having slight inertia and slight resistance to change in flow direction, passes through the openings above to a multitube centrifugal separator which removes any remaining mist or fine liquid droplets.

2428 APTIC NUMBER 20714

Burke, James P.
APPARATUS AND METHOD FOR TREATING GASEOUS PRODUCTS OF COMBUSTION. (Assignee not given.) U. S. Pat. 3,476,524. 7p., Nov. 4, 1969. 4 refs. (Appl. Feb. 21, 1966, 8 claims).

Apparatus and methods for treating gaseous products of combustion are provided for connection with the exhaust pipe of an internal combustion engine or with a chimney flue or other gas discharge conduit leading from the combustion chamber of a furnace or other heating equipment employing coal, wood, or fuel oil. Gases coming from an internal combustion engine are restricted and subsequently enlarged in a confining apparatus wherein the heavier particles of material are deposited. They are passed through filters which remove any carbon and oils in the gas, and the gases then are restricted in a passage which forces them up through a liquid absorbent which caused the dissolution of and absorption of lead and sulfur. The gases are then again restricted and forced into a confining apparatus wherein are contained sequently arranged solid treating materials, the first of which contains both adsorbents and absorbents, the second of which is a solid oxidant material, and the third a solid catalytic material. Gases from chimneys are led into a confining means wherein they are diverted into two directions and treated in substantially the same manner as engine gases. A first compartment contains a solid material which both absorbs and adsorbs carbon monoxide and any oil, a second compartment oxides carbon monoxide to carbon dioxide and any unburned hydrocarbons, while a third compartment breaks up heavy metal compounds and converts any remaining unburned hydrocarbons. A preferred composition of the washing liquid comprises about 75% decahydronaphthalene, 11% alcohol, 11% ether and 3% dissolved camphor, while the solid adsorbent and absorbent composition is predominantly alumina and cuprous chloride. A preferred composition of solid oxidants for the removal of heavy metal is activated alumina 85%, sodium permanganate 10%, nickel oxide 10%, cobalt 10%, copper chloride 10%, ad palladium 15%; a suitable catalyst composition is activated alumina 50%, activated magnesium oxide 30%, boron 5%, cobalt 5%, and palladium 10%.

2429 APTIC NUMBER 21006

Burt, Leslie R.
AIR TREATMENT. (Beratron, Inc., Arcadia, Calif.) U. S. Pat. 3,486,308. 5p., Dec. 30, 1969. 21 refs. (Appl. Jan. 2, 1968, 1 claim).

An air treatment device is described which is capable of removing obnoxious odors from the air, collecting bacteria for test purposes, and generating negative ions to promote the comfort and health of patients. The exterior housing has apparatus for filtering particulate matter, such as dust and pollen from air flowing through an inlet opening. An ultraviolet lamp is located within the interior housing and generates radiation having a wave length above 1800 A for sterilizing and negatively ionizing the air. A blower is provided, causing the air to flow through the filter apparatus and the interior housing, while a plurality of baffles increases the path length of the air flow to longer than the length of the interior housing, thereby exposing the air flowing through to the ultraviolet radiation for greater periods of time. The surfaces of the interior housing and of the baffles are provided with a reflective finish, thus increasing the effects of the ultraviolet radiation. Growth medium may be supported within the interior housing to collect bacteria from the air passing through. Switch apparatus is provided to turn off the untraviolet lamp so that the bacteria are not killed during the sampling process, until after they are grown when they may be killed by redirecting the radiation. (Author abstract modified)

2430 APTIC NUMBER 20715

Buswell, Richard F., Herbert J. Setzer, and Richard A. Sederquist
HYDROGEN GENERATOR INCLUDING DESULFURIZATION WITH LOW PRESSURE HYDROGEN FEEDBACK. (United Aircraft Corp., East Hartford, Conn.) U. S. Pat. 3,476,534. 5p., Nov. 4, 1969. 9 refs. (Appl. Sept. 26, 1967, 6 claims).

Fuel cell power plants include two separate main sections: the fuel cell proper, which reacts oxygen (or air) with hydrogen to form electricity; and the hydrogen generator which reacts a combination of hydrocarbon fuel and water to generate hydrogen gas for use in the fuel cell reacter. In order for the efficiencies of a fuel cell to reach maximum value, many applications would be enhanced by the ability of the fuel cell to

use commercially available hydrocarbon fuels as a source of hydrocarbons for the hydrogen generation: this would require desulfurization within the hydrogen generator. A method is described which utilizes low pressure hydrogen to enrich hydrocarbon fuels for hydrodesulfurization, without the need to supply pumps for increasing the pressure of gaseous hydrogen. Some portion of the hydrogen generated at the output of the palladium-silver separator is fed through a valve and a feedback line to be mixed with hydrocarbon fuel at the inlet to a boiler. The boiler provides a superheated vapor of hydrocarbons and molecular hydrogen which is then passed into an organic sulfur converter which generates hydrogen sulfide. Most of the sulfur in the hydrocarbon fuel will combine to form hydrogen sulfide, which is removed from the feedstock in a condenser. The condenser also serves to reliquify the desulfurized fuel so that it may be pressurized in a liquid pump rather than requiring a pump capable of operating in the gas phase.

2431 APTIC NUMBER 21198

Buswell, Richard F.
HYDROGEN GENERATOR FOR INCLUDING DESULFURIZATION WITH DIFFUSED HYDROGEN FEEDBACK. (United Aircarft Corp., East Hartford, Conn.) U. S. Pat. 3,476,535. 5p., Nov. 4, 1969. 9 refs. (Appl. Sept. 26, 1967, 5 claims).

Fuel cell powerplants include 2 separate main sections: the fuel cell which reacts oxygen to form electricity together with waste hydrogen and air by products as well as heat and water; and the hydrogen generator, which reacts a combination of hydrocarbon fuel and water to generate hydrogen gas for use in a fuel cell reactor. The usefulness of fuel cells is mitigated due to the need for special refining of the hydrocarbon fuel so as to achieve a low sulfur content prior to use in a fuel cell power plant. A hydrogen generator utilizing steam and hydrocarbon fuel as the reactants and including a desulfurization device and a hydrogen feedback system is described. Hydrogen is recycled and fed to the steam stream by means of a diffusion device. The hydrogen is fed back serially or in parallel from any point downstream of a stream reforming reactor. (Author abstract modified)

2432 APTIC NUMBER 20407

Buttgereit, Werner, Christoph H. Voges, and Christoph Schilter
EXHAUST EMISSION CONTROL BY FUEL INJECTION: THE VW 1600 WITH ELECTRONICALLY CONTROLLED FUEL INJECTION SYSTEM. Preprint, Society of Automotive Engineers, Inc., New York, 7p., 1967. 3 refs. (Presented at the Society of Automotive Engineers, Southern California Section Meeting, Oct. 9, 1967. Paper 680192.) (Also: to meet U. S. Emission Standards Volks FITS Fuel Injection Unit. S.A.E. (Soc. Automot. Engrs.) J., 76(6):58-61, June 1968.)

Volkswagen's electronic fuel injection system cuts vehicle emissions to within regulatory limits without impairing performance. Fuel is injected simultaneously into pairs of intake ports. Fuel supply pressure is held constant, while the injection duration is electronically varied according to engine operation condition. Engine speed and absolute pressure in the intake manifold form the basic input to the computation unit. The use of the absolute-pressure value eliminates the need for an altitude correction. Ancillary controls provide enrichment at starting, cold-starting enrichment, warmup enrichment, full load enrichment, and deceleration fuel shutoff. Tests on many VW engines show average emissions of 238 part per million of hexane and 0.97 volume% of carbon monoxide. These values are within lawful limits. They result from the extreme accuracy of both the fuel metering and the mixture distribution to the individual cylinders of the engine. The injection engine's performance is identical to that of the standard twin-carburetor engine. The design specifications give the best possible compromise between emissions, torque characteristics and specific fuel consumption. Injection period varies between 3 and 9 milliseconds in the final design. Injection timing is constant at 15 degrees after top dead center, under all operating conditions. Timing is not as critical in gasoline engines at it is in diesel engines.

2433 APTIC NUMBER 21488

Cady, Cullison
FOR CLEANER AIR. PART I. Highway User, 1967:14-17, Nov. 1967. PART II. Ibid., 1967:14-17, Dec. 1967. PART III. Ibid., 1968: 16-19, Feb. 1968.

Automobile emissions include hydrocarbons, oxides of nitrogen, and carbon monoxide. These pollutants get into the air through the exhaust, the crankcase, the carburetor, and the fuel tank. California, because of its unique pollution problems, has been initiating most of the anti-pollution legislation. Auto manufacturers are developing control devices for their products. The Federal agencies directly concerned with vehicle air pollution are the Bureau of Mines and the Public Health Service. A joint government-automotive-oil industry program to forward fundamental research projects in the air pollution field has been established. Automotive emissions on new cars are low enough to seriously consider whether any further reduction is practical from an economic standpoint.

2434 APTIC NUMBER 20296

Calvert, Willard R., Sr.
METHOD AND APPARATUS FOR GAS DECONTAMINATION. (Assignee not given.) U. S. Pat. 3,498,024. 8p., March 3, 1970. 5 refs. (Appl. March 26, 1968, 10 claims).

Air purification is important in maintaining the enclosed, independent atmosphere of submarines, space ships, etc. where air is reused through an indefinite time. An air purifying gas separation arrangement which has efficient heat removal during adsorption of gases and vapors is described. The adsorbent bed is held within a housing of suitable structural material. During adsorption, a conduit carries contaminated air under feed pressure to a space beneath a perforate grid which supports the adsorbent bed. As the contaminated air flows upward, through active adsorbent, oxygen, nitrogen, and C-H-O gases are separated

from carbon dioxide, moisture, and contaminants which may be present. Gases which precede CO2 in chromatographic sequence emerge from the adsorbent bed, while the CO2, moisture, and other contaminants are retained. A number of heat exchange separators prevent gaseous re-contamination due to accumulation of heat of adsorption, and allow heat transfer to the bed during desorption so that desorbants are rapidly released to disposal.

2435 APTIC NUMBER 20283

Calvert, Willard R.
TREATMENT OF CONTAMINATED GASES AND THE LIKE. (Assignee Not Given.) U. S. Pat. 3,497,328. 5p., Feb. 24, 1970. 10 refs. (Appl. April 26, 1966, 8 claims).

A device for the removal of pollutants from a contaminated gas stream is described. The process employs substances which may or may not be catalytically treated, and permits the recovery of useful waste products and re-use of the catalyst. The contaminated gas is delivered to a housing through a pipe in counterflow relation for contact with regenerated solids. Some of the solids are bypassed around the gas delivery pipe for carrying contaminant gases and vapors away from the gases being decontaminated before displacement by other pollutants. The discharged solids are treated in chambers with an aqueous fluid for pollutant removal, and with air for water vapor removal and heat transfer. (Author abstract modified)

2436 APTIC NUMBER 20425

Carls, E. L.
REVIEW OF BRITISH PROGRAM ON FLUIDIZED-BED COMBUSTION: REPORT OF U. S. TEAM VISIT TO ENGLAND FEBRUARY 17-28, 1969. Argonne National Lab., Ill., Chemical Engineering Div., 48p., Aug. 1969. 28 refs.
CFSTI: ANL/ES-CEN -1000

A U. S. team visited British organizations that are concerned with the development of fluidized-bed combustion systems for fossil fuels, and obtained information on research facilities, experimental results, development programs in progress, and expected future work. Experimental efforts and conceptual design studies are aimed at the development of four types of fluidized-bed coal-combustion systems: an atmospheric-pressure utility-sized unit, an industrial shell boiler, a pressurized fluidized-bed combustor, and a packaged water-tube boiler. In addition, application of the technique of fluidized-bed combustion to various fuel-oil burning systems is being studied. A variety of coals can be burned in a fluidized bed of coal ash at about 800 C with superficial gas velocities of 2-14 ft/sec without sintering or agglomeration, and carbon monoxide can be reduced to less than 0.1 vol %, which is equivalent to 0.3% carbon loss. Lower carbon losses were achieved in experiments at low gas velocities (2 ft/sec) and using coal crushed to minus 1/16 in.; the higher losses occurred in experiments at high gas velocities (14 ft/sec) and with coal crushed to minus 1/4 in. Recycling the elutriated material to the bed produced data to indicate that 95% overall efficiency can be achieved for an industrial shell-boiler design and greater than 99% for a conceptual utility-sized fluidized-bed combustor. Sulfur dioxide emission into the flue gas has been reduced by as much as 99% by the additon of 1 and 1/3 to 2 times the stoichiometric quantity of limestone along with the coal feed at a superficial gas velocity of 2 ft/sec. A preliminary cost comparrison between utility-sized units and projected to 1975 indicates capital charges of $132/kW for conventional pulverized-coal-feed units, compared with $120/kW for fluidized-bed combustion, or $137/kW to $125/kW if limestone injection were included. Decreased corrosion, erosion, and fouling of tubes would also be expected due to the lower temperature of combustion, which should result in less vaporization of alkali compounds. Problem area requiring resolution are coal distribtion, air distribution, and recycle of elutriated fines. (Author abstract modified)

2437 APTIC NUMBER 20782

Carruthers, John and John Winsor
DESULPHURISATION AND HYDROGENATION OF AROMATIC HYDROCARBONS. (British Petroleum Co. Ltd., London (England)) U. S. Pat. 3,488,496. 8p., Dec. 16, 1969. 14 refs. (Appl. Oct. 3, 1966, 14 claims).

Cataytic desulfurization of an aromatic hydrocarbon-containing fraction containing up to 50 ppm wt sulfur, including thiophene sulfur, is effected in the presence of hydrogen without appreciable hydrogenation of the aromatic hydrocarbons or production of a substantial amount of hydrogen sulfide. The fraction, together with hydrogen, is contacted at an elevated temperature and pressure with a supported nickel catalyst. Hydrogen flow is controlled to maintain the equilibrium hydrogen partial pressure greater than the minimum necessary to prevent catalyst deactivation as sulfur is adsorbed by the catalyst, but less than that at which up to 10 mol percent hydrogenation of the aromatic hydrocarbons occurs. The desulfurized fraction, still under pressure and containing up to 2 ppm wt sulfur, is hydrogenated over a supported nickel catalyst in two stages. The bulk of the hydrogenation, 90 to 99% wt, occurs in the first stage with cooling so as to control the stage temperature within desired limits, and the hydrogenation is completed in the second stage, without cooling. (Author abstract)

2438 APTIC NUMBER 20672

Cartier, George T.
HIGH EFFICIENCY PARTICULATE AIR FILTER. (Keystone Filter Media Co., Norristown, Pa.) U. S. Pat. 3,490,211. 6p., Jan. 20, 1970. 15 refs. (Appl. July 31, 1967, 4 claims).

A high efficiency particulate air filter is described with as much as about 240% increased surface area per unit volume. It comprises a continuous array of a multiplicity of primary pleats and secondary pleats of laminated planar filtering material, preferably consisting of an inner layer of microporous fibers held between two outer layers of porous paper, at least one of which is a stiff supporting material. Each series of primary pleats is folded into a plurality of larger secondary pleats extending from the inlet to the outlet end of the frame. Each side of each secondary pleat

comprises an equal number of primary pleats. At the end of each series of primary pleats and, thus, at the end of the side of a secondary pleat, a pair of end primary pleats is expanded sufficiently to permit a reverse fold to be made in the array and the next side of secondary pleats is placed alongside the previous side. The primary pleats are expanded a predetermined distance to permit airflow at a rate up to the maximum capacity of the filter material, while the sides of secondary pleats are also separated a predetermined distance to permit air passage. The beginning and end parts of the continuous array of filtering material are each sealed and fastened to an adjacent side of the filter frame, preferably by adhesive material, and the top and bottom edges of the filter element are sealed against the top and bottom walls, respectively, of the frame.

2439 APTIC NUMBER 20728

Cates, Henry J. Jr. and Tom Rosenberg
MIXING CHAMBER FOR THE END OF AN INCINERATOR ROTARY KILN.
(Assignee not given.) U. S. Pat. 3,489,527. 5p., Jan. 13, 1970.
2 refs. (Appl. Oct. 19, 1966, 2 claims).

An arrangement is described for the discharge end of a rotary kiln employed in a continuous incineration operation. A hood arch configuration adjacent the discharge end of a rotary kiln extends downwardly in front of the kiln to protect the discharge end from the reflective heat which would be created in the mixing chamber into which the kiln discharges. An offset wall acts as a baffle to cause turbulence of the gases as they pass from the rotary kiln. A bridge wall acts as a baffle and a deflector and directs gases from the end of the rotary kiln back towards the gas flow from the kiln. (Author abstract)

2440 APTIC NUMBER 20294

Celayan, Genaro G.
SMOG-CONTROL EQUIPMENT FOR INTERNAL COMBUSTION ENGINES, INCINERATORS AND BOILERS. (Assignee not given.) U. S. Pat. 3,499,282. 7p., March 10, 1970. 7 refs. (Appl. Oct. 13, 1967, 6 claims).

Smog control devices which eliminate volatile matter, carbon monoxide, and hydrocarbons from the exhausts of internal combustion engines, home incinerators, and boilers are described. An elongated chamber has an air inlet and an exhaust gas inlet at one end, with a series of butterfly vanes mounted for rotation along the length of the chamber. A spark-plug between each adjacent pair of butterfly vanes ignites the exhaust gas and air mixture as it passes along the length of the chamber. By means of the vanes, the chamber is divided into a number of separate blast chambers. The spark plugs provide a repetitive spark to give each blast chamber a source of heat energy to burn the volatile matter in the exhaust gases. As the vanes turn under the influence of moving gas, they permit the passage of the gas from one blast chamber to another where the remaining volatile matter is reduced and the CO gases are eliminated. Eventually, the processed gas passes from the last blast chamber and is then exhausted into the atmosphere.

2441 APTIC NUMBER 20699

Celenza, G. J.
AIR POLLUTION PROBLEMS FACED BY THE IRON AND STEEL INDUSTRY.
Plant Eng., 24(9):60-63, April 30, 1970.

Solutions to the air pollution problems in the iron and steel industry are discussed. The steel producing process involves a number of steps with potentially troublesome exhaust emissions. Coke and sinter operations, which produce raw materials for the blast furnace, contribute to the overall plant pollution problem. Coke ovens emit smoke, dust, and combustion products. These contaminants can be lessened by isolating or enclosing storage areas, using dust control devices, and employing proper operating techniques. The dust emissions from sintering facilities can be controlled by using cyclone separators as primary cleaners and electrostatic precipitators as secondary cleaners. By employing a dust catcher, wet scrubber, and electrostatic precipitator, 96% of the dust from the blast furnace can be eliminated. Pollution control equipment for the refining furnances includes electrostatic precipitators, high energy scrubbers, and bag filters. The specific advantages and limitations of each of these devices are discussed.

2442 APTIC NUMBER 21633

Celenza, G. J.
DESIGNING AIR POLLUTION CONTROL SYSTEMS. Preprint, UGI Corp., Harrisburg, Pa., 13p., 1970. (Presented at the Air Pollution Seminar, Harrisburg, Pa., March 24, 1970.)

Six key factors in designing an air pollution control system for a plant are discussed briefly. These are: (1) source correction, involving a review of the manufacturing operation to reduce emissions; (2) determination of the properties of the plant's emissions by sampling and testing; (3) design of the collection and transfer system; (4) cooling of the hot exhaust; (5) selection of the treatment device; and (6) dispersion of the final exhaust. Prevailing pollution control regulations and cost factors are among other important considerations. A sample project scheme for designing a control system is given.

2443 APTIC NUMBER 21203

SULFUR RECOVERY PROCESS SWEETENS SOUR GAS. Chem. Eng. News, 48(18):68-69, April 27, 1970.

A sulfur recovery process based upon the reaction between hydrogen sulfide and sulfur dioxide, which goes nearly to completion very rapidly in molten sulfur and in the presence of a catalyst, is described. A large number of nitrogen compounds can catalyze the reaction, but ethylenediamine is most suitable. The reaction is preferably run in a turboreactor, but may also be carried out in other contacting devices such as packed columns or buble-cap columns. A comparison of this method with other common sulfur

recovery processes is included. Advantages include no significant pre-treatment of the feed gas and no purification of the product sulfur. The fact that the reaction medium is identical with one of the reaction products eliminates the need for the expensive separate reaction medium required in many other processes.

2444 APTIC NUMBER 20758

Christman, John R.
HEAT GENERATOR. (Assignee not given.) U. S. Pat. 3,485,191. 2p., Dec. 23, 1969. 7 refs. (appl. Feb. 8, 1968, 4 claims).

A boiler with a heat exchanger and chimney is located over a firebox with a radiation core and designed to discharge only completely burned combustion products to the atmosphere. In operation, the products of combustion travel from the firebox, up an updraft duct, and to the chimney. Any incompletely burned products are directed by baffles to manifolds for collection and then pulled back to be reburned by the action of a suction blower drawing the products through feed ducts and against the radiation core, where they are reburned and begin the cycle over again.

2445 APTIC NUMBER 21676

Clark, J. H.
CONTROL OF AIR POLLUTANTS IN THE ELECTROPLATING INDUSTRY. Plating, 57(7):707-710, July 1970. (Presented at the American Electroplaters Society Annual Convention, 56th, Detroit, Mich., June 19, 1969.)

The control of fumes in the electroplating industry can be achieved by a variety of wet-scrubbing equipment. The contaminants are transported to the scrubber by means of a hood and ducting system. The packed type of fume scrubber is one of the most suitable for removing gaseous impurities. Because of the corrosive nature of the contaminants, special precautions in design must be taken. Mists are generally more easily removed than gaseous impurities. The impingement-type wet scrubber is very efficient in removing mist. The venturi-type wet cyclone fume scrubber is frequently used for removing entrained mist, and more frequently on dust particles. Before buying equipment, consideration should be given to size requirements, operating costs, initial cost, and expected life of the equipment.

2446 APTIC NUMBER 20445

Clark, L. J.
SHIPS THAT NEVER WERE. Gas J., 1966:297-304, March 23, 1966.

A history of marine transport of liquefied natural gas (LNG) is presented, beginning with the unsuccessful development of river barges, by the Union Stockyards of Chicago, intended for bringing LNG from Louisiana to Chicago. Several proposed design approaches are reviewed; the successfully operated prototype ship Methane Pioneer and its two 173,000 bbl-capacity follow-up vessels, Methane Princess and Methane Progress, are used to transport LNG from Arzew, Algeria, to Canvey Island, Great Britain, and Le Harve, France.

2447 APTIC NUMBER 21245

Closner, J. J.
STORING CRYOGENS WITH PRESTRESSED CONCRETE. Cryogenic Eng. News, vol. 1:14-17, July 1966. 4 refs.

Prestressed concrete has recently become viable for use as a cryogenic storage material. The most recent tank design consists of vertically and circumferentially prestressed sections with nickel steel liners. For large tanks, dome roof costs rise sharply with an increase in internal operating pressure. The tanks must be cooled with design gradients for certain structural elements in mind. In general, this means a cooling rate of 1 F per hour. An advantage offered by these tanks is that they present the option of being built above ground, below ground, or partially below ground. Economic variables in tank storage include foundation and site conditions, tank size, and proper planning.

2448 APTIC NUMBER 21481

Cofield, W. W.
LNG IN GAS TRANSMISSION. Pipe Line Ind., 26(6):43-46, June 1967. (Presented at Southern Gas Association Annual Meeting, Dallas, Tex., April 10-12, 1967.)

The functional description of an LNG peak-shaving plant operated by a pipe line corporation is presented. Located at the terminus of the pipe line, the plant consists of a gas conditioning section, a liquefaction section, a cryogenic in-ground storage system, and a send-out system. The gas conditioning section compresses the gas and removes those constituents which would solidify at cryogenic temperatures. Principle among these are CO2 and water. The cryogenic storage system is designed around a 290,000 barrel capacity frozen earth type storage tank. The central element of the send-out system are the two vaporizers which operate in parallel. Advantages claimed for the LNG peak shaving plant are compatibility of its output with the customer's regular gas supply, and being on the terminal of the system; storage volumes are delivered by displacement to all storage customers without the construction of additional transmission facilities.

2449 APTIC NUMBER 21518

Conviser, S. A.
MOLECULAR SIEVES USED TO REMOVE MERCAPTANS FROM NATURAL GAS. Oil Gas J., 63(49):130-132, 135, Dec. 6, 1965.

Molecular sieves can reduce mercaptan and heavier sulfur-compound levels of natural gas to less than 0.05 grain/100 scf. Adsorbent

capacity and life are good, and the operating and investment costs are little higher than those for a dehydrator of the same size. The selectivity of molecular sieves for polar molecules results in a high capacity for sulfur compounds - about 8 times greater than copper - impregnated activated carbon. Both Type 5A and Type 13X molecular sieves showed excellent adsorption capacities, but initial tests also showed Type 13X to be the preferred adsorbent. Unlike smaller pore-size sieves, Type 13X cannot sieve out large molecules, and coadsorption becomes a design consideration. To design a system where coadsorption is involved, every constituent of the gas stream must be considered. Once the gas composition is defined, available data will help to make design predictions of equilibrium capacities. A molecular sieve bed has four adsorption zones to remove heavy sulfur compounds from natural gas. Water is adsorbed to full equilibrium capacity in the first section, while in the second zone, incoming water displaces sulfur compounds and the coadsorbates. Incoming sulfur compounds are next adsorbed to coadsorption equilibrium capacity, and finally, sulfur compounds transfer from inlet composition through gas phase adsorbed phase and leave at an effluent content of less than 0.05 grain H2S/100 scf. Commercial experience shows that a properly designed molecular-sieve sulfur-removal system can perform for 3 to 5 years before new adsorbent is required.

2450 APTIC NUMBER 21375

Coordinating Research Council, Inc., New York, N. Y., Motor Vehicle Fuel, Lubricant, and Equipment Research Committee
1966 CRC VAPOR LOCK TESTS. Proj. CM-63-66, Rept. 420, 142p., Nov. 1968. 6 refs.

Vapor lock road tests were conducted to determine the effect of exhaust emission control systems on vapor locking tendencies of cars, to study the effect of fuel volatility on fuel system temperatures, and to study correlation of fuel system temperatures relevant to vapor lock with temperature-vapor/liquid ratio characteristics of fuels. Limiting volatility was defined as the temperature-vapor/liquid ratio curve of fuel causing a 25% increase in acceleration time following an engine-off or idle soak. Tests were made with thirteen cars equipped with factory-installed exhaust emission control systems as supplied in 1966 models sold in California, and thirteen of matching make and model not so equipped. A series of fuels were used with different vapor forming characteristics. The effect of exhaust emission control system on the vapor locking tendency of the cars tested was not significant on a pooled basis, although differences (both higher and lower) for some individual car pairs were significant. In the full throttle acceleration procedure, ninety percent of the cars evaluated were more critical at the engine-idle soak condition and 10% were more critical at the engine-off soak condition. Temperatures measured in eight cars showed carburetor bowl and tank temperatures to be always higher in the equipped cars than in the non-equipped cars. Fuel pump temperatures were usually higher in equipped cars, averaging 6 to 8 F higher at soak and 5 to 10 F higher at idle. No consistent effect of fuel volatility within a fuel series on fuel system temperatures was found. Under the test conditions employed, hot stalling was much less prevalent than vapor lock. (Author summary modified)

2451 APTIC NUMBER 20447

Corbett, R. W. and C. B. Davies
GROUND STORAGE OF L.N.G. Gas World Gas Coke, vol 163:355-359, March 12, 1966. 10 refs. (Presented at the Monte Carlo Congress on Petroleum and the Sea.)

Experiences with in-ground storage of LNG (liquefied natural gas) is reviewed, beginning with experiments conducted by 'Shell' Research, Ltd., in 1960 (using a 5 ft diameter, 5 ft deep earth pit), to the 112 ft diameter, 114 ft deep excavated ground cavity used by CAMEL natural gas liquefaction plant at Arzew, Algeria. Other sites discussed are a 20 ft diameter, 20 ft deep storage experiment conducted at Lake Charles, Louisiana, and a 115 ft diameter, 165 ft deep storage cavity constructed by the Transcontinental Gas Pipe Line Corporation near the Hackensack River in New Jersey. Isotherm diagrams of the two experiment sites are presented.

2452 APTIC NUMBER 21310

Costa Novella, E. and J. A. Trevino Revert
ABSORPTION ACCOMPANIED BY A CHEMICAL REACTION. I. ABSORPTION OF SO2 BY AQUEOUS SOLUTION OF SODIUM SULFITE. (Absorcion con reaccion quimica. I. Absorcion de SO2 por disoluciones acuosas de sulfito sodico). Text in Spanish. Anales Quim., 66(2):185-194, Feb. 1970. 17 refs.

Experimental results of the study of sulfur dioxide absorption in aqueous solutions of Na2SO3 indicate that absorption occurs by means of an almost irreversible second-order reaction that is infinitely rapid in the liquid phase. The theoretical aspects of three systems are discussed: 1) SO2-H2, 2) SO2-air-NaOH-H2O, and 3) SO2-air-Na2SO3-H2O.

2453 APTIC NUMBER 21332

Costa Novella, E. and J. A. Trevino Revert
ABSORPTION ACCOMPANIED BY A CHEMICAL REACTION. II. ABSORPTION OF SO2 BY AQUEOUS SOLUTIONS OF POTASSIUM DICHROMATE AND MONOETHANOLAMINE. (Absorcion con reaccion quimica. II. Absorcion de SO2 por soluciones acuosas de dicromato potasico y monoetanolamina). Text in Spanish. Anales Quim., 66(2):195-202, Feb. 1970. 3 refs.

Absorption of sulfur dioxide in an aqueous solution of potassium dichromate takes place by means of an irreversible, moderately rapid second-order reaction, and it is possible to determine the rate constant. Absorption in ethanolamine is irreversible and fast, and is also a second-order reaction. The mechanism of these reactions, according to the film-penetration theory of Toor and Marchello, is the one that best agrees with the experimental results.

2454 APTIC NUMBER 21135

Coutant, R. W., R. H. Cherry, H. Rosenberg, J. Genco, and A. Levy
INVESTIGATION OF THE LIMESTONE-SO2 WET SCRUBBING PROCESS. (FINAL REPORT). Battelle Memorial Inst., Columbus, Ohio, Columbus Labs., NAPCA Contract PH 86-68-84, Task 17, 67p., Nov. 30, 1969.
CFSTI: PB 188708

The wet lime sulfur dioxide scrubbing process was investigated on a laboratory scale in support of full-scale prototype studies. The investigation consisted of experiments in the following areas: measurement of the overall rate of uptake of SO2 in a stirred-pot reactor; measurement of the relative rates of hydration of selected limestones and dolomites; measurement of the relative rates of dissolution of selected limestone and dolomite materials; and chemical analysis of selected dolomite- and limestone-based liquors prepared at three temperatures. Lime in particulate form reacts with various sulfur species or carbonate in solution to yield a coating which inhibits utilization of the bulk of the lime. However, because of the observed tendency for particles to become cemented together in large clusters, a high degree of utilization of the lime may not be possible as long as the lime is admitted to the scrubber in particulate form. It is recommended that further consideration be given to the importance of particle size in the overall scrubbing process. Furthermore consideration should be given to the possibility of predissolving the lime, or limestone, in the feed water to the scrubber through the use of excess carbon dioxide or other solubilizing agents. (Author summary modified)

2455 APTIC NUMBER 20539

Coutant, R. W., R. E. Barrett, and E. H. Lougher
SO2 PICKUP BY LIMESTONE AND DOLOMITE PARTICLES IN FLUE GAS. Preprint, American Society of Mechanical Engineers, New York, 9p., 1969. 7 refs. (Presented at the Winter Annual Meeting of the American Society for Mechanical Engineers, Los Angeles, Calif., Nov. 16-20, 1969, Paper 69-WA/APC-1.)

An investigation was made of the reaction between sulfur dioxide and limestone and dolomite particles in flue gas. Reaction data were generated by exposing the particles to localized boiler-furnace conditions. Variables included in the study were residence time, temperature, particle size, SO2 concentration, and chemical state of the stone. A model is hypothesized for the SO2-particle reaction that is consistent with the experimental data. The hypothesis states that the initial reaction products are sulfites, and that as the particle temperature rises above 1400 F, SO2 is lost by the thermal decomposition of the sulfite. Concurrent with these steps, the sulfite can be oxidized and/or disproportionate to form sulfate. The net result is a maximum in sulfur pickup during the first second of exposure in the reactor. (Author abstract modified)

2456 APTIC NUMBER 20675

Cox, Richard W.
EXHAUST FILTRATION AND COLLECTOR SYSTEM. (Assignee not given.) U. S. Pat. 3,487,607. 5p., Jan 6, 1970. 24 refs. (Appl. Dec. 14, 1967, 4 claims).

A filtration and collector system is described which removes foreign particles from contaminated air by first heating the air for combustion of the particles, then subjecting the foreign particles to bombardment from liquid streams created by a rotary impeller, condensing the liquid from the air, and finally passing the air through a fine mesh filter screen. The liquid used to provide the high velocity streams is circulated through a recovery tank wherein the particles removed from the air stream are separated from the liquid and the liquid is resupplied to the impeller. The impeller casing may also be provided with external blades to propel the exhaust stream through the housing; the pitch, size, and number of these blades can be varied according to the desired velocity of the exhaust stream. Cooled baffle walls and a refrigeration coil condense the liquid as well as the foreign vapor from the air. (Author abstract modified)

2457 APTIC NUMBER 20552

Craig, T. L.
RECOVERY OF SULFUR DIOXIDE FROM STACK GASES: THE WELLMAN-LORD SO2 RECOVERY PROCESS. Preprint, Kentucky Univ., Lexington, 11p., 1970. (Presented at the Industrial Coal Conference Lexington, Ky., April 8, 1970.)

The Wellman-Lord sulfur dioxide recovery process, a wet regenerative system which recovers at least 90% of the SO2 from stack gas in excess of 97% of any SO3 and acid mists from the gas, and about 90% of the fly ash is described. This process, which uses either potassium or sodium, can be adapted to small industrial units, smelters, and fossil fuel-fired generating plants. The end products from the process can be gaseous or liquid sulfur dioxide which can be converted to sulfuric acid or elemental sulfur through the addition of commercially available equipment. The process has been demonstrated at the Maryland Clean Air Demonstration Plant, Baltimore, Md., and the first commercial unit is being installed. Capital and operating costs are reviewed and power cost increments of 0.40 mil per KWH for 2.5% sulfur coal and 0.44% for 5.0% sulfur coal are reported.

2458 APTIC NUMBER 21246

ALAGASCO LNG INSTALLATION SHOWS COST REDUCTION. Cryogenic Eng. News, vol. 1:28-31, Oct.-Nov. 1965.

A natural gas liquefaction, storage, and regassification system has several economic and technical advantages. Peak shaving gas can be supplied at one-half to one-third the cost of other pipeline companies. The plant is capable of expansion at minimum cost. It is equipped with all standard safety devices, and

presents no unique safety considerations. Plant officials contend that technological advances reduce the possibility of another 'Cleveland disaster' to virtually zero. A flow diagram is included, and plant operation is explained from the source of incoming gas to the point of final departure.

2459 APTIC NUMBER 21230

FIRST COMMERCIAL LNG PLANT ON STREAM. Cryogenic Eng. News, vol 1:26-30, Jan. 1966.

Liquefaction and storage of natural gas in an above-ground vessel began Sept. 25, 1965 for a Wisconsin natural gas company. Major considerations in the company's selection of liquefied natural gas (LNG) over a propane-air plant were the size of storage required, the interchangeability of LNG with normal pipeline gas, and the large volume of peak shaving gas involved. The storage tank capacity is 72,000 barrels. Insulation material is perlite within a nitrogen atmosphere. The liquefaction process is designed to produce a net daily fill rate of one MMCF. It can accept gas of varying composition interchangeably. The plant sendout system is designed to pump, vaporize, superheat, and odorize liquid at a rate of 25 MMCF of equivalent gas dailly, with 100% standby capabilities. The control system completely moniters all process variables. The cascade liquefaction cycle, propane and ethylene refrigeration cycles, and vaporizations are described in detail.

2460 APTIC NUMBER 21247

INTEGRALLY-BUILT METHANE TANKER. Cryogenic Eng. News, vol. 3:22-27, May 1966.

The French-built methane tanker Pythagore has an integral design consisting of thin membranes through which cargo loads and stresses are transferred to the hull plates. The cargo installations offer great flexibility, permitting the transportation of a number of liquid gases. The cargo tank design is such that much larger versions could be manufactured. If a tear were to appear in the tank, it would have no tendency to spread, due to energy absorbing walls. Tightness of the tanks is so great that leakage is undetectable by measuring equipment aboard. The ship is equipped with a re-liquefaction plant to save boil-off.

2461 APTIC NUMBER 21240

LNG PLANT FEATURES. Cryogenic Eng. News, vol. 1:23-25, Feb. 1966.

A liquid natural gas (LNG) facility near San Diego has probably the most sophisticated of the instrumentation and control systems yet installed in any on-stream LNG plant, and has a unique cycle built around an available pressure differential that, in essence, furnishes refrigeration at no cost other than capital expenditure. Another innovative system design is the ability to operate the plant unattended under remote supervision, with automatic alarms and shut-down switches. The balance of the plant processes are standard ones. A flow chart and instrumentation table are given.

2462 APTIC NUMBER 20320

Daigh, Harold D.
EXHAUST RECYCLE SYSTEM. (Atlantic Richfield Co., Phila., Pa.) U. S. Pat. 3,500,807. 7p., March 17, 1970. 4 refs. (Appl. March 4, 1968, 22 claims).

An internal combustion exhaust system is described wherein air is injected into the exhaust manifold to reduce hydrocarbon and carbon monoxide emissions. A method is provided for rendering an exhaust manifold air injection system compatible with an exhaust recycle system wherein a portion of the exhaust gas is recycled into the induction manifold by plugging or removing the air injection tubes which furnish air to the exhaust gas which is recycled, for example, to those exhaust ports supplying exhaust gas to the heat riser.

2463 APTIC NUMBER 21282

Daubresse, Guy
DEVICE FOR PURIFYING A GAS AT HIGH TEMPERATURES. (Dispositif d'epuration d'un gaz a haute temperature). Text in French. (Societe Francaise des Constructions Babcock et Wilcox, (Paris) Swiss Pat. 470,207. 6p., May 14, 1969. (Appl. April 21, 1967, 10 claims).

A device is proposed for the elimination of gaseous, liquid, or solid impurities contained in a gas at a temperature between 1,000 and 2,000 C, while recovering at least a part of the heat energy of the gas as a by-product. It contains a primary cylindrical chamber with cooled walls; the longitudinal wall of this chamber has a tangential port of entry for the gases to be purified. One of the transversal walls at the end of the chamber contains an orifice by which the gases leave the chamber in such a way that the entering gases create a turbulent movement that causes the foreign elements contained in the gases to be deposited on the walls of the chamber. The impurities are condensed and removed in the form of slag.

2464 APTIC NUMBER 20721

Deary, Reynaldo M.
AIR POLLUTION FILTER APPARATUS. (Assignee not given.) U. S. Pat. 3,478,495. 5p., Nov. 18, 1969. 11 refs. (Appl. Jan. 23, 1968, 6 claims).

An apparatus is described for automobile exhaust systems which utilizes water to entrap air pollutants. It comprises a structure to which water and polluted air are delivered and

where the air and water come into contact. One container is a source of water supplied to the water-air contacting apparatus and the other is a source container for water which has been delivered to the water-air contacting apparatus and was not there vaporized. The two containers are connected by a passageway and valve system which permits recirculation of the water without recirculating those pollutants which are solid or are reduced to liquid form by contact with water and which float upon it. When the pollutant laden air is contacted with water, some of the water is vaporized and contains pollutants which are dissolved or suspended in the vapor, while other pollutants collect or float on the surface of the water and are carried away and discharged as liquids and solids. (Author abstract modified)

2465 APTIC NUMBER 21212

Denig, Fred and Robert E. Powers
METHOD AND APPARATUS FOR TREATING METALLURGICAL FURNACE GASES. (Koppers Co., Inc., Monroeville, Pa.) U. S. Pat. 3,480,427. 4p., Nov. 25, 1969. 13 refs. (Appl. July 26, 1967, 2 claims).

Oxygen bearing gases are mixed with gases from a metallurgical furnace which contain carbon monoxide to burn the carbon monoxide and to heat further the gases; the heat from the gases is applied to a quantity of scrap metal disposed in a metallurgical furnace to preheat such scrap metal. The liberated heat from the oxidation of CO to carbon dioxide is given up to a heat retentive medium in a pebble heater. Cold air passing through the pebble heater absorbs heat and the heated air is directed onto cold scrap in a second basic oxygen furnace to preheat the scrap, which is subsequently melted and refined. The CO containing off-gases from the second BOF are burned and the heat recovered in a second pebble heater. Heat is permitted to be removed from the pebble material in the lower chamber at approximately the same time heat is being stored in the pebble material in the upper chamber. (Author abstract modified)

2466 APTIC NUMBER 20756

Deussner, Herbert
METHOD AND DEVICE FOR REMOVING DUST FROM EXHAUST GASES. (Klockner-Humboldt-Deutz A. G., Cologne (West Germany)) U. S. Pat. 3,485,012. 4p., Dec. 23, 1969. 5 refs. (Appl. March 11, 1968, 7 claims).

A method for removing dust from the exhaust gases of a cement manufacturing installation is based on increasing the dewpoint of the gases. After leaving a raw-powder-preheater, the gases are conducted to the lower portion of a vertically extending moistening compartment. Water in an excess amount is sprayed into the upwardly moving gas stream and the excess water is loaded with dust collects in a sump at the bottom of the compartment. A pump withdraws the muddy water from the sump and discharges it first to nozzles tangentially extending into the sump to circulate its contents and then to the upper portion of the compartment to wet the inner wall. Another pump conveys a portion of the muddy water from the sump to the raw-powder-preheater at a point before the one where the raw powder is introduced. (Author abstract modified)

2467 APTIC NUMBER 21695

Diener, Rudolf
METHOD FOR THE REDUCTION OF THE CO-CONTENT OF THE EXHAUSTS OF ELECTRICALLY IGNITED COMBUSTION ENGINES. (Verfahren zur Verminderung des CO-Gehaltes der Abgase von mit elektrischer Zuendung versehenen Verbrennungsmotoren). Text in German. (Assignee not given.) Swiss Pat. 452 996. 2p. March 15, 1968. (Appl. Nov. 22, 1966, 5 claims).

A method for the reduction of carbon monoxide emissions from combustion engines has been devised. It is characterized by supplying the engine with a fuel to air mixture which contains less fuel than the stoichiometric ratio for complete combustion of the fuel would demand. For generating the ignition spark a voltage is produced which reaches the break-down value in less than 20 microseconds. Through the rapid increase of the ignition voltage the harmful effects of unburned fuel are avoided. Experiments have shown that not only the CO content but the hydrocarbon content could be markedly reduced as well. In practice best results were obtained with a weight ratio of air to fuel of about 14.5:1 and with a break-down voltage reached in 1 microsecond.

2468 APTIC NUMBER 20658

Doig, George and Donald E. McGeachy
DIRECTIONAL MOUNTING PLATE FOR AIR LINE FILTER. (Numatics, Inc., Highland, Mich.) U. S. Pat. 3,470,897. 3p., Nov. 18, 1969. 6 refs. (Appl. May 14, 1965, 1 claim).

In pneumatic circuits it is desirable to have an air filter for the removal of moisture, dirt particles, and oil from air used in control circuits. Improvement in a mounting plate for an air line filter is described, whereby the direction of air flow through the filter is the same, regardless of which port of the mounting plate is used as an air inlet. The porting in the supporting base and the head plate for the filter element is so arranged that a 180 deg rotation of the head plate relative to the supporting base reverses the air inlet and air outlet of the supporting base, and the proper direction of air flow through the filter element can be maintained, regardless of which port in the supporting base is used as the air inlet. (Author abstract)

2469 APTIC NUMBER 20323

Dooley, James L.
VEHICLE POWER SYSTEM INTENDED FOR REDUCED AIR POLLUTION. (McCulloch Corp., Los Angeles, Calif.) U. S. Pat. 3,493,066. 7p., Feb. 3, 1970. 5 refs. (Appl. Feb. 28, 1968, 14 claims).

A vehicle power system is described to function with reduced air pollution, utilizing an engine of reduced volumetric capacity,

and adapted to store a portion of the engine output during periods of light loading. The power system includes engine apparatus adapted for operative connection with the motion producing apparatus to supply power for inducing body movement. Power take-off equipment is connected with the engine apparatus diverting a small proportion of the power output to the power storage apparatus, and power accumulated and stored may be redelivered to the engine at predetermined times and at extremely high rates of energy transfer. One method includes providing an engine to supply mechanical power to the motion producing equipment and, in diverting a portion of the mechanical power output of the engine, to drive a flywheel which is rotated to store mechanical energy. The flywheel is selectively engaged with the engine to provide a mechanical power supplement at predetermined times. (Author abstract modified)

2470 APTIC NUMBER 20873

Dorman, R. G.
THE DYNAMICS OF AIR STERILISATION. Chem. Ind. (London), no. 46:1946-1949, Nov. 18, 1967. 6 refs.

The aerodynamic behavior of small particles is reviewed to show why they do not sediment rapidly, but persist as aerial dispersions, and why devices such as impingers, cyclones, and spray towers are not suitable for high-efficiency removal. Fibrous filters containing many fibers below one micron diameter are suggested as the solution to the great majority of air sterilization problems. These filters are cheaper than methods involving high temperatures and are capable of dealing with high air flows. Where absolute certainty of sterilization is essential, flows are small, and cost is no object, heat sterilization might be considered. Although the low penetration rates required by fermentation tanks or effluent gas disposal cannot be measured by physical methods, bed depth or the numbers of filters in a series can be calculated if penetrations through thinner beds or sheets of the same materials are measured.

2471 APTIC NUMBER 21532

Duffy, A. R. and J. Dainora
ENGINEERING STUDIES SHOW POSSIBILITIES FOR LNG PIPE LINE. Pipe Line Ind., 27(2):42-49, Aug. 1967. 13 refs. (Presented at the Distribution Conference of the Operating Section of the American Gas Association, St. Louis, Mo., May 1-4, 1967.)

The feasibility of piping liquefied natural gas over considerable distances was studied, including the establishment of modular transmission distances and the evaluation of commercially available materials for their utility in an LNG pipeline. While a distance between pumping stations of 25 miles and between cooling stations of 375 miles could be obtained using evacuated multilayer insulation, a more economical solution would probably be to use urethane foam insulation with pumping stations every 25 miles and cooling stations every 100 miles. The cost of maintaining the evacuated condition was the governing factor. The materials of construction exist such that transmission of LNG over considerable distance appears to be feasible. Chief among the pipe materials are the aluminum alloys, stainless steel, and high nickel content steel. Insulation with the required properties is commercially available. Preliminary methods of accommodating the thermal contraction problem appear satisfactory. Other design problems that need to be investigated include thermodynamic transients during cool-down, warm-up, or intermittent operation and stress analysis for intermittent operation.

2472 APTIC NUMBER 20458

Eakin, B. E. and C. G. von Fredersdorff
BELOWGROUND STORAGE OF LIQUEFIED NATURAL GAS. Chem. Eng. Progr., 58(11):46-50, Nov. 1962. 13 refs.

Methods of storing natural gas by compression, adsorption by activated charcoal or by Fuller's earth, absorption by propane, hydrate formation, and liquefaction are reviewed, together with methods of storing liquefied natural gas (LNG) in existing caverns, mined caverns, and below-ground containers, particularly those made of prestressed concrete. A comparison of construction costs of above-ground 9% nickel-steel tanks, of mined caverns and below-ground prestressed concrete tanks, showed that the investment and operating costs of the latter are the lowest of the three. One of the major contributions to the operating costs is the evaporation of LNG due to heat influx into the tank from the ground. To estimate this quantity, a heat transfer model leading to a boundary-value problem in heat conduction was formulated, the solution of which in closed form was obtained with the air of the Laplace transform method. In addition, a thermal model of below-ground concrete tank was constructed to obtain the form of the 32 F isotherm in the ground surrounding the tank as a function of time. The isotherms determined with this model are shown in a graph. The mechanical loading of a below-ground concrete tank, the effect of low temperatures on the concrete, and the prestressing wire and the adopted preliminary design of the tank are considered and discussed. The final tank design must await the results of tests on a 30 ft diameter 8 ft high 'demonstration tank'.

2473 APTIC NUMBER 20556

Eakin, B. E.
NON-CONVENTIONAL STORAGE OF NATURAL GAS. Am. Gas J., vol. 187: 20-24, Nov. 1960. 6 refs. (Presented at the American Gas Association Production Conference, New York, N. Y., 1960.)

The feasibility of various proposed techniques for below-ground, large-volume storage of natural gas near the point of consumption was studied. The techniques examined include storage in the gas phase at high pressure and by absorption in liquids, adsorption on solids, reversible chemical combinations, and liquefaction. The best known absorbent of natural gas (assumed to be pure methane) is propane. The solubility of methane in propane at different temperatures and pressures is given in a graph. The maximum content of methane in the solution at a given temperature is that which raises the vapor pressure of the solution to the storage pressure. About 16 standard cu ft of methane can be

adsorbed in 1 cu ft of activated charcoal at 70 F and 40 lb/sq in. Up to 200 std cu ft of natural gas can be adsorbed on 1 cu ft of Fuller's earth at -1250 F and at atmospheric pressure. Each of the four lightest hydrocarbons, CO2, and H2S will form hydrates in the presence of water under certain temperature and pressure conditions. About 170 std cu ft of methane per 1 cu ft of hydrate can be stored at 35 C and 450 lb/sq in. About 630 std cu ft of natural gas is contained in 1 cu ft of liquefied gas at -250 to -260 F of atmospheric pressure. The temperature, pressure, and volume requirements of various storage methods are summarized. A comparison of these methods and of surface tanks vs. mined caverns showed that underground storage of liquefied natural gas has the greatest merit.

2474 APTIC NUMBER 20446

Ebdon, J. Fred
CRYOGENICS ON THE PACIFIC. Gas, vol. 41:66-86, Aug. 1965.

Detailed description of the liquefied natural gas (LNG) plant constructed by the San Diego Gas and Electric Company is given, together with an extensive historical review. The double-wall steel storage tank for this installation has a capacity of 175,000 bbl and was constructed by the Chicago Bridge and Iron Co. The installation flow sheet is diagrammed and explained. Molecular sieve pre-purification is used and the cold box is comprised of three heat exchanges and four expanders. Natural gas can be delivered from LNG storage at a rate of 66 MMcfd at 400 psia and 60 F. Plant controls and instrumentation are also reviewed.

2475 APTIC NUMBER 20415

Eberhardt, James E. and John A. Beck
PROCESS AND CONTROL FOR PRODUCING ANTI-EMISSION CARBURETORS. Preprint, Society of Automotive Engineers, Inc., New York, 5p., 1969. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690138.)

The advent of emission controls for automobiles in California in 1966 triggered a period of expansion in carburetion technology. The need for greater uniformity of the mass-produced product is explained by references to the 'flow specification' ('flow curve') of a carburetor which shows the required variation of the air-fuel ratio with increasing air flow as the throttle is moved from the curb idle position to the wide open position. The admissible deviations from the optimal flow curve developed by designers are confined to a 'flow band' bracketing the 'flow curve'. It also explains with the aid of shifted 'bell curves' the effect of uncontrolled variations of the temperature and pressure of ambient air, and of the temperature and specific gravity of the fuel on the variation of the air-fuel ratio, which has led the production engineers to the conclusion that meaningful measurements on a carburetor can be made only in a controlled-environment test facility. A description of this facility is followed by those of some pieces of new test equipment for float setting, port relation gaging, idle screw balance adjustment, bore-to-bore air leakage balance and air testing of metering components and subassemblies of carburetors, whose operation is explained with the aid of semi-schematic illustrations.

2476 APTIC NUMBER 20593

Ebert, Fritz
CALCULATION OF THE BOUNDARY LAYER FLOW IN CYCLONES. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(7):5-10, July 1969. 1 ref.

In cyclone separators, a powerful flow forms in the vicinity of the walls and is directed toward the apex of the cyclone cone. This radial boundary flow is largely responsible for entraining the separated material and transporting it to the dust outlet. Some of the angular momentum possessed by the fluid is absorbed by friction on entering the cyclone. Because its magnitude is the decisive factor in separation, it is necessary to determine the angular momentum loss occurring primarily in the boundary layer. A mathematical treatment of these problems is presented. Local velocity profiles and sheer stress along the walls are calculated by an approximation method to obtain predictions of angular momentum and quantity of fluid transported in the boundary layer. The theoretical values are in good agreement with measured values.

2477 APTIC NUMBER 20635

Ebert, Paul
GAS CLEANING APPARATUS AND MORE PARTICULARLY TO AN IMPROVED ELECTRICAL PRECIPITATOR. (Societe Anonyme Aeropur A. G., Zug (Switzerland)) U. S. Pat. 3,492,790. 5p., Feb. 3, 1970. 22 refs. (Appl. March 20, 1968, 1 claim.)

Ionization processes for purifying gases and contaminated air rely on bombardment from ions produced by the rotation of turnstiles, connected to a high-voltage generator, to decant and remove impurities. The present invention concerns improvements in the doughnut-like form of turnstiles, provided with electrodes and flanked at their ends by hollow cross members carrying nozzles and points, described in U. S. Pat. 3,443,362. The improvements are directed in particular to the separation of the insulating base of the shaft carrying the turnstiles from the cleaning chamber and to augmentation of the decanting surface. The two electrode turnstiles are mounted on a rotating shaft in an insulated support, which in turn is mounted in a cell separate from and sealed from the cleaning chamber. The decanting surfaces are augmented by the interposition of concentric decanting shields, the first of which extends to a volute-shaped inlet for the gases. Spray nozzles located on the shields and chimney wall spray liquid in the direction of the swirl imparted by the volute to increase the draft and accelerate the scrubbing of the gases without the enlargement of the installation. For more complete and adjustable ionization, the electrode turnstiles are mounted so that their distances from the decanting shields can be regulated as required.

2478

APTIC NUMBER 21265

Edwards, Geoff
WHAT PRICE A CLEAN ATMOSPHERE? Engineering (London), 209(5428): 485, May 15, 1970.

The Cat-Ox system, now being marketed in the United Kingdom, is designed to reduce sulfur dioxide and fly ash emissions from flue gases. However, it is believed that this system will be very expensive, if adopted. There are two versions of the Cat-Ox system, one for use as an independent system which can be fitted to the existing plant, and the other for installation as original equipment. Both remove all the fly ash from the flue gas and about 85% to 90% of the SO2. The first unit is the electrostatic precipitator which removes the fly ash, followed by a catalytic converter to convert SO2 to sulfur trioxide. The flue gases are then cooled in an economizer. An absorbing tower cools the flue gases and sulferic acid is condensed and absorbed by direct contact with a cooled stream of recirculated acid. A mist eliminator removes any H2SO4 mist in the flue gas after it has passed through the absorbing tower. An induced draught fan moves the gas through the system and exhausts it up the stack. The capital cost of providing a Cat-Ox system for a power station in the U. K. is $28 - $42.00 per Kilowatt of installed capacity. Extra capital cost of $2.80 M is produced for a small 100 MW generating station.

2479

APTIC NUMBER 21575

Edwards, H. H.
EFFICIENT NEW HEAT EXCHANGER SUITED TO LNG VAPORIZATION. Oil Gas J., 65(4):96-99, Oct. 2, 1967. 6 refs.

A new heat-exchange device for cryogenic fluids is based on the submerged-combustion techniques but is not a true submerged combustion design. The burning of fuel takes place above the liquid level, rather than below the burning of fuel takes place above the liquid level, rather than below the surface, and combustion products are exhausted directly into a liquid bath at a point below the surface. This direct contact gives the water a highly turbulent motion, and causes the gas-water mixture to rise. To take advantage of this lifting action, a confining weir is provided, so water circulates up through the weir annulus and over the weir to quiet water in the tank. The exchanger-tube coil is immersed in water in the annular area between the downcomer and the weir, that the gas-water mixture scrubs the surface of the tube coil as it rises. This system is limited to the heating or vaporizing of fluids not requiring an outlet temperature above 100-125 F. Design specifications and operating performance are reviewed for two LNG vaporization units.

2480

APTIC NUMBER 20332

Eguchi, Yoshitomo
ADSORPTION AND SEPARATION OF HYDROCARBON BY ACTIVE CARBON. (Kasseitan niyoru tankasuiso no kyuchaku bunri). Text in Japanese. Sekiyu Gakkai Shi (J. Japan Petroleum Institute, Tokyo), 13(2):105-111, Feb. 25, 1970. 40 refs.

With the development of petroleum chemistry, the importance of fractionating petroleum to a simple chemical element and elements which have chemicophysical properties has increased. Only when various ways which differ in principles of separation (distillation, absorption, adsorption, extraction, and reaction) are combined and high-purity elements separated economically can processes which used the elements be developed. Separation is divided into three aspects: purification, collection or recovery, and fractionation. Adsorption is particularly effective when elements of low boiling point and low density are to be separated. The technique has not had widespread application, but interest in it is increasing as interest in separation grows. Adsorption and separation of hydrocarbons by the activated carbon method is of interest to the petroleum and natural gas industry.

2481

APTIC NUMBER 21675

Eickelpasch, D.
SPECIAL PROBLEMS OF AIR POLLUTION IN STEEL PRODUCTION PLANTS. (Spezielle Probleme der Luftreinhaltung bei den Stahlerzeugungsprozessen). Text in German. VDI (Ver. Deut. Ingr.) Ber., no. 149:274-278, 1970.

The brown smoke of steel plants consist of Fe2O3 and Fe3O4, while ranging in size from 0.01 to 0.1 micrometer. For removal of the fine dusts to a residual dust content of 150 mg/cbNm, venturi scrubbers are presently used. Several types of exhaust systems are commonly employed. The gas with 70 to 90% by volume CO and 10 to 30% CO2 is drawn off through an open hood and completely or partially burned in the presence of additionally added air. Alternately, a small fraction of the converter waste gas is drawn off between an outer and inner hood and cleaned separately from the dust. Thus, an access of air through the inner hood is avoided. In the other method, the space between the converter opening and exhaust hood is screened off from the ambient air by nitrogen. The exhaust system determines the dimensions of the scrubbers. Gases must be cooled to 40 to 80 C prior to scrubbing. This is done in a heat exchanger and by injection of water. At a water temperature of 20 C, 3.7 kg/cbNm dry flue gas are needed. The collection efficiency of the scrubbers is determined by the intensity of the contact between water and dust and by the condensation effect.

2482

APTIC NUMBER 21329

Eickmeyer, Allen G.
PROCESS FOR PURIFICATION OF GASES. (Verfahren zum Reinigen von Gasen). Text in German. (Allen G. Eickmeyer, Prairie Village, Kansas) Swiss Pat. 467,094. 7p., Jan. 15, 1969. (Appl. March 23, 1965, 11 claims).

A process for the removal of acid gases, primarily carbon dioxide and hydrogen sulfide, from a gaseous mixture is described wherein the pollutants are removed through contact with an aqueous absorbant. The absorbant contains a larger fraction of a weakly alkaline potassium salt in the form of a carbonate, borate, phosphate, or arsenite and a small quantity of amine catalyst in

the form of an ethylene polyamine, alkanol amine, or a compound of the reaction between an alkanol amine with a boric acid or a salt of the boric acid. The dirty gas is cleaned in two stages. The cleaned gas is separated from the load absorbent. The latter is regenerated with water vapor in two stages. Partially regenerated absorbant 80 to 96% of the total quantity of regenerated absorbent from the first stage is returned to the first absorption stage. Almost completely regenerated absorbent (4-20%) is returned to the second absorption stage. The temperature in the second absorption stage is below the temperature in the first absorption stage. The regenerated absorbent from the second stage is cooled by heat exchange with the dirty gas. Addition of 9.5% diethanol amine borate solution to an aqueous potassium carbonate solution reduced the CO2 content from 17% to 0.06%. A two stage scrubber for acid natural gas with 2% H2S and 7% CO2 operating with hot potassium carbonate solution yielded a cleaned gas with more than 0.2 g H2S/2.8 cu m. Upon addition of diethanol amine borate (ratio of borine to nitrogen 2:1), so that a ratio of borine: potassium of 1:1 was obtained, the H2S content dropped to 0.015 g H2S/2.8 cu m.

2483 APTIC NUMBER 20494

Eifel, P. J.
RAILROAD AND HIGHWAY TRANSPORTATION OF LNG. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 10p. 5 refs. (April 7-12, Session no. 6, Paper 38.)

A comparison is developed between railroad tank cars, highway trailers, truck mounted vessels and demountable tankage, based on the length of haul, volume of shipment, frequency of usage, cost of equipment, and expense of operation. Decreasing cost of cryogenic equipment due to design development and improved technology as exemplified by the history of cryogenic railroad cars is outlined. A tank car for the transportation of liquefied natural gas (LNG), together with applicable regulations, freight rates, and railroad handling procedures is presented. A vacuum insulated, optimum design trailer is described and its function is compared with truck mounted vessels and demountable tankage. State highway laws and their effect on trailer design are discussed briefly, and some unloading methods are presented and their applications evaluated. (Author abstract modified)

2484 APTIC NUMBER 20694

Ekman, Frank
FILTER BED FOR DUST COLLECTOR. (National Dust Collector Corp., Skokie, Ill.) U. S. Pat. 3,488,039. 9p., Jan. 6, 1970. 8 refs. (Appl. May 20, 1968, 16 claims).

Many filter devices for wet gas scrubbers use glass or metal spheres to provide a diversity of pathways for gas flowing through the filter bed. While the spheres provide large surface areas in which the liquid particles impinge and contact the gas for collecting contaminants, both elements present problems. Glass tends to fracture easily and metal spheres available in the desired tolerances are expensive and hard to obtain. The present invention eliminates the need for glass or metal spheres, yet provides a filter bed with excellent filtering characteristics. The bed comprises elongated filter elements disposed in spaced apart, side-by-side relation transversely across the flow path of the gases in the scrubber. Each filter element includes a substantially large exterior surface for direct contact with the gases flowing around and between adjacent elements in the bed, and each is supported in a manner permitting limited movement toward and away from adjacent elements. Each can be rotated about its longitudinal axis so that particles collected on the surface are continuously being dislodged and removed by the rolling and vibrating action. Because the filter elements are movable and the spacing between them is continuously changing, dimensional tolerances are not required of the filters. Thus, many types of commercially available rods, tubes, and pipes are suitable for use in the filter bed.

2485 APTIC NUMBER 20364

Ekman, Frank O.
METHOD AND APPARATUS FOR CONTOLLING FUME AND DUST EMISSIONS FROM CUPOLA FURNACES AND THE LIKE. (National Dust Collector Corp., Skokie, Ill.) U. S. Pat. 3,499,264. 5p., March 10, 1970. 5 refs. (Appl. June 12, 1968, 6 claims).

Common methods of controlling air-contaminating dust and fume emissions from cupola furnaces involve removing the gases from an off-take located above the charging opening of the stack or a portion of the gases at a level some distance below the charging opening. The former method results in increased operating costs because the dust collector must be large enough to handle all the gases generated in the furnace. The second method is more economical but subject to rapid oxidation of explosive proportions when excessive outside air flows into the stack through the charging opening. The installation described overcomes these limitations and requires that only a minimum volume of gas be treated to attain stack gas relatively free of fumes and dust. The furnace stack includes a charging opening spaced outwardly from the lower end and a blast gas tuyere system adjacent to the lower end of the stack for blowing the charge or burden in the furnace stack. A portion of the gases generated in the furnace flows upward through the charge and is drawn off at a level between the tuyere system and the charging opening. This portion is then passed to a dust collector for the removal of fume, dust, and other contaminants. A blanket of inert, noncombustible stack is introduced into the cupola stack to prevent the infiltration of excessive outside air and greatly reduce the risk of explosions.

2486 APTIC NUMBER 20676

Ellinger, Karl
ELECTROFILTER WITH CORRUGATED SHEET METAL-TYPE COLLECTING ELECTRODES. (Klockner-Humboldt-Deutz A. G., Cologne (West Germany) U. S. Pat. 3,482,375. 3p., Dec. 9, 1969. 11 refs. (Appl. June 28, 1968, 2 claims).

An electrofilter is described with several corrugated sheet metal-type collecting electrodes arranged parallel at mutual

spacing for a gas flow directed transversely or inclined to the approximately vertically extended corrugation troughs and ridges. It is meant to improve the utilization of space by the elimination of pockets which are contacted neither by the gas current nor by electric field, and to attain in the entire interior of the electrofilter uniformly spreading electric fields as far as possibel to all sides. The flow cross-section to both sides of the crests of the corrugation ridges of adjacent collecting electrodes is made narrower, and spark electrodes are provided in the center of the widened spaces formed between the opposed crests of adjacent collecting electrode ridges.

2487 APTIC NUMBER 20888

Emery, W. B. II, E. L. Sterrett, and C. F. Moore
GAS FROM ALASKA FOR JAPAN. Calif. Oil World, 60(22):6-8, Nov. 1967.

Contracts were signed in 1967 for two U. S. firms to supply two Japanese gas and electric utilities with 50 billion scf of natural gas per year, in liquid form, for 15 years starting in 1969. The gas will be produced from the Kenai and North Cook Inlet Fields in Alaska, with liquefaction plant, storage, and dock at Port Nikiski, Alaska. The cold Alaska climate creates numerous unique problems in materials, construction, and pipeline and equipment freezing. The liquefaction plant design capacity is for 172.6 million scf of gas per stream day. The feed gas to the plant is somewhat unusual in that it is essentially pure methane. The liquefaction process is to be a special heat recovering cascade design using propane, ethylene, and methane as the refrigerants. The process. compressors and drives, gas treating, cold box, cooling, power systems, and storage and tanker facilities are described. There will be a total storage capacity of 675,000 barrels from three steel tanks. Two special oil tankers will each have a cargo capacity of 440,000 barrels of LNG, equivalent to 1.5 billion cu ft of gas. The ships are described in detail; their cargo tanks will use membranes, a departure from previous practice. The receiving terminal near Yokohama will have four steel tanks with a total storage capacity of about 1 million barrels.

2488 APTIC NUMBER 20750

Eng, Jackson, Gordon H. Thomson, and Ronald C. Vanderlinden
HYDRODESULFURIZATION OF BLENDED FEEDSTOCK. (Esso Research and Engineering Co., Linden, N. J.) U. S.Pat. 3,475,327. 5p., Oct. 28, 1969. 3 refs. (Appl. Oct. 28, 1966, 13 claims).

In conventional hydrodesulfurization or hydrorefining operations, unstable petroleum fractions cannot be processed along with conventional naphthas and gas oils in the presence of conventional hydrorefining catalysts. Thus the processes require large numbers of hydrorefiners, separators, and stripping towers. In the case of olefinic feeds, facilities such as multiple cascade bed reactors must also be provided to control the heat of reaction. The present invention provides hydrodesulfurization process which adequately desulfurizes a blend of fractions, including unstable, olefinic fractions, boiling at 50-1200 F in a single unit employing the same condition and catalyst for all fractions. From 20-80 vol percent of virgin naphtha is blended with 10-70 vol percent of a gas oil and 10-70 vol percent of an unstable hydrocarbon fraction consisting of coker naphtha, steam cracked naphtha, and coker gas oil. The blend is hydrodesulfurized in any suitable, conventional reactor with a catalyst comprising a mixture of a member of Group VI oxides and sulfides with iron, cobalt, or nickel oxides and sulfides deposited on a porous carrier. The reaction is preferably carried out at 600-750 F and 350-600 psig. The gas should contain 70-100 vol percent hydrogen. The desulfurized blend is recovered and fractionated to obtain a gasoline fraction, a reformer feed stock fraction, and a heating oil fraction.

2489 APTIC NUMBER 20718

Eng, Joseph W. and Stanley C. F. Lin
METHOD OF AND APPARATUS FOR PURIFYING POLLUTED GASES. (Electro-Sonic Pollution Control Corp., New York) U. S. Pat. 3,494,099. 18p., Feb. 10, 1970. 7 refs. (Appl. Aug. 30, 1967, 26 claims).

A method and apparatus are described for removing contaminants from polluted gases which eliminates the need for the present high chimney structures. It comprises a low flow resistant, porous, infinite capacity filter in which ultrasonically generated, oscillating fog of substantially increased contact area and conduct duration, contacts, absorbs and agglomerates contaminants carried by such gases, and from which the absorbed agglomerated contaminants are removed. The fog is provided downstream of the filter, and the polluted gases are passed through the fog before entering the filter. Preferably the fog droplets are charged electrically and activated chemically, as well as generated in a range of sizes best suited for removing contaminants from the polluted gases. The gases can also be passed through ultrasonically generated fog, at least some of which is frequency modulated. (Author abstract modified)

2490 APTIC NUMBER 21581

STORING GAS IN FROZEN GROUND. Engineering (London), 1967: 499-501, Sept. 29, 1967.

One method of storing natural gas is to keep the gas deep underground in porous water-bearing rock strata, thereby simulating the conditions in a natural gas well near the load center. The first frozen ground liquid gas stores in the United Kingdom are being built at Canvey Island. Each of the four units will have a capacity of 21,000 tons which, added to the capacity of the above-ground tanks, will give an ultimate storage capacity of 110,000 tons. The store consists of a pit in the ground into which liquefied gas is fed at about -161 C. The liquid itself cools the surrounding earth; ground water freezes to form an insulating ice wall which grows outward with time until an equilibrium diameter is reached. From the store, liquid gas is evaporated and boosted to mains pressure. Boil-off from the tanks can be collected and compressed for use. The construction of the pits and problems associated with freezing are also discussed.

2491 APTIC NUMBER 20309

Engle, Charles J.
TREATMENT OF OILS TO REDUCE VISCOSITY AND SULFUR CONTENT.
(Phillips Petroleum Co., Bartlesville, Okla.) U. S. Pat.
3,496,097. 3p., Feb. 17, 1970. 4 refs. (Appl. Jan. 17, 1968,
1 claim).

Viscosity and sulfur content of an oil are reduced by maintaining the oil at 500 to 700 F for at least 24 hours, preferably longer, while the gases evolved are cooled and separated to produce fuel gas and condensate. The condensate is blended with the heated oil to reduce its viscosity still further and provide a material that can be transported more readily, while the fuel oil is utilized to heat the oil to be treated, thereby eliminating or substantially reducing the fuel requirements of the treating process and utilizing the gases which are evolved.

2492 APTIC NUMBER 21145

Epstein, Samuel S. and Marjorie Burroughs
SOME FACTORS INFLUENCING THE PHOTODYNAMIC RESPONSE OF PARAMECIUM CAUDATUM TO 3,4-BENZPYRENE. Nature (London), 193(4813):337-338, Jan. 27, 1962. 7 refs.

In a study of the photodynamic response of Paramecium caudatum to 3,4-benzpyrene, test agents were mixed with equal volumes of both cell and aqueous suspensions of 3,4-benzpyrene. The mixtures were then dark-incubated and afterwards irradiated in appropriate mixtures of nitrogen and oxygen. Under anaerobic conditions, the photodynamic response of Paramecium to 3,4-benzpyrene proved to be completely inhibited, thus involving a photoxidation process. Butylated hydroxy anisole and alpha-tocopherol protect Paramecium against photodynamic toxicity. Other antioxidants, such as ascorbic acid, propyl gallate, and butylated hydroxy toluene, however, were without a protective effect. Of 15 individual Cohn fractions of bovine plasma proteins tested, greatest protection was affored by beta-lipoprotein and alpha-globulin. The protective effects of gamma-globulin, albumin, and glycoprotein were negligible. Enhancement of the photodynamic response was obtained with mono- or divalent anions of sodium and potassium salts, by their addition to the incubation mixture of cells and hydrocarbons. Enhancement was also produced by increasing the pH of the incubation system or by the use of cells from aging cultures.

2493 APTIC NUMBER 20775

Ermenc, E. D.
CONTROLLING NITRIC OXIDE EMISSION. Chem. Eng., 77(12):193-196, June 1, 1970. 1 ref.

Industries using nitric acid in their processes should now be planning to meet the anticipated legal standards, which may limit emissions of nitrogen oxides to about 500 ppm. Data for controlling emissions are presented. The reaction kinetics of nitrogen and oxygen in air are characterized at high temperatures by standard second-order equations, while the reaction becomes zero orders at temperatures below 2000 F. Because the reverse reaction rate is many times greater than the forward rate, cooling must be very rapid to retain nitric oxide, and very slow to promote its reversion to oxygen and nitrogen. The problem of pollution control is that most processes involving high temperatures are designed for minimum residence time (i.e., rapid cooling) to reduce capital requirements. Below 3200 F, the rate of formation controls nitric oxide production; above 3200 F, the reverse rate is the controlling factor. Nitric oxide production departs from equlibrium at a maximum around 2800 F, and then approaches equilibrium at 3200 F. As 3200 F is passed, the departure from equilibrium becomes more pronounced with rising temperature, showing the effect of the reverse reaction rate. Emissions could be lowered by some of the following means: better recovery through refrigeration, cooler circulating acid, or the compression of nitrogen oxides after the condensing phase; a good balance of oxygen after condensation to oxidize nitric oxide; catalytic incineration of tail gases to reduce nitrogen oxides to nitrogen and oxygen; and further absorption tail gases in an alkaline tower followed by catalytic incineration. Besides being a function of temperature, the formation of nitric oxide also depends on the amount of excess air used in a process.

2494 APTIC NUMBER 21617

Fachvereinigung Metallhuetten und Umschmelzwerke E. V., Emissionsausschuss and Gesellschaft Deutscher Metallhuetten - und Bergleute E. V., Hue Mendusschuss fuer Kupfer und Alknliche Metalle
RESTRICTION OF EMISSION COPPER-ORE MILLS. (Auswurfbegrenzung Kupfererzhuetten). VDI (Ver. Deut. Ingr.) Richtlinien, no. 2101, Sept. 1966. 14 refs. Translated from German by D. Ben Yaakov, Israel Program for Scientific Translations, Jerusalem, 13p.
CFSTI: TT 68-50469/7

The technology of copper mills is reviewed with respect to dust separation methods and factors affecting dust content for the various operations in the production cycle: roasting furnace, sintering grate, shaft furnace, reverberatory furnace, copper-matte converter, copper refining (anode) furnace, copper electrolysis, and wirebar furnace. Engineering means of reducing emissions from each of these processes, except electrolysis which does not produce any dust-bearing gases, are described: cyclones, electrostatic precipitators, dust chambers, multicyclones, and fabric filters. Factors affecting the efficiency of various dust collectors are outlined. For newly constructed copper mills and new units, an emissions limit of 0.3 g/cu m STP is established for the various processes. In addition, new roasting furnaces, sintering machines, and converters must be designed to ensure that all SO2-bearing flue gases from these units are used in sulfuric-acid manufacture, and stack-height regulations must be followed. It is noted that dust control is of economic as well as environmental interest, since the dust emitted from a copper mill constitutes a loss of valuable metals such as zinc, tin, lead, and copper.

2495 APTIC NUMBER 21479

Fails, J. C. and W. D. Harris
PRACTICAL WAY TO SWEETEN NATURAL GAS. Oil Gas J., 58(28):86-90, July 11, 1960. 11 refs.

Comparison tests were made on a number of adsorbents to determine their capacity, selectivity, and regenerative ability with respect to the removal of hydrogen sulfide from natural gas. Best results were obtained with a molecular-sieve type. Using the molecular sieve, additional tests were performed to identify optimum pressure, temperature, and contact time parameters. Reducing operating temperature increased system efficiency. Adsorption increased with contact time up to a limit of about 170 sec. Optimum adsorption pressure was about 450 psia. It appears that the adsorption of some components at higher pressure increases faster than the total bed capacity. Water vapor in the gas stream decreased the adsorptive capacity of the bed.

2496 APTIC NUMBER 20279

Faitani, Joseph J. and William W. Mieczkowski, Jr.
SMOKE REDUCTION COMBUSTION CHAMBER. (United Aircraft Corp., East Hartford, Conn.) U. S. Pat. 3,498,055. 6p., March 3, 1970. 9 refs. (Appl. Oct. 16, 1968, 14 claims).

A combustion chamber for a gas turbine engine which substantially eliminates the production of smoke while maintaining all other performance parameters is described. A number of plunged holes are positioned at the front end of the combustion chamber. The size and location of these holes are optimized to provide a critical airflow into the combustion zone. An annular ram scoop is positioned around the holes to increase the pressure of the in-flowing air. It also provides for a more uniform flow through the passage leading to the holes, making the airflow through each of them nearly the same. An air shroud is placed around the fuel nozzle which imparts a swirling motion to the incoming air. The swirling air provides an increase in the fuel spray angle, and locally aerates the fuel directly downstream of the fuel nozzle along the burner can centerline. This front end configuration eliminates local fuel rich regions and provides a means for mixing incoming fuel and air.

2497 APTIC NUMBER 21700

Peitrelmayer Karl and Karl Conradi
DEVICE FOR IMPROVEMENT OF THE COMPOSITION OF THE EXHAUST OF DIESEL ENGINES DURING IDLING. (Vorrichtung zur Verbesserung der Zusammensetzung der Abgase von Dieselmotoren im Leerlauf). Text in German. (Maschinenfabrik Augsburg-Nuernberg A. G., Munich W. Germany)) Swiss Pat. 457 032. 3p. May 31, 1968. (Appl. Oct. 13, 1967, 1 claim).

Disagreeable odors in the exhaust of diesel engines during idling can be reduced by diminishing the fresh air supply. This is achieved by installation of a throttle valve in the fresh air intake duct which reduces the air supply in accordance with the lower fuel supply during idling. The position of the throttle valve can be adjusted by the piston of a pneumatic actuator, which is connected to the pneumatic control system. The latter operates the fuel control system.

2498 APTIC NUMBER 21005

Feldman, H. F., W. H. Simons, J. J. Gallagher, and D. Bienstock
KINETICS OF RECOVERY SULFUR FROM THE SPENT SEED IN A MAGNETOHYDRODYNAMIC POWER PLANT. Environ. Sci. Technol., 4(6):496-502, June 1970. 7 refs. (Presented at the American Chemical Society Division of Fuel Chemistry, 157th Meeting, Minneapolis, Minn., April 1969.)

The open-cycle magnetohydrodynamic (MHD) power plant offers a unique means of profitably recovering sulfur from coal combustion products. In such a plant, the combustion products are seeded with a potassium or cesium seed to make them electrically conductive. The seeding material, which has a great affinity for sulfur, must be recovered and recycled for the power plant to be economically feasible. Before recycling the slag-feed mixture to the generator, the sulfur in the mixture can be removed and converted to hydrogen sulfide with a hydrogen feed gas. The hydrogen sulfide can then be separated from the hydrogen by stripping with an ethanolamine solution and converted to elemental sulfur via the Claus oxidation process. Experimental and kinetic analyses of the conversion process are described, with the data obtained used to specify the design and operation conditions for a sulfur recovery reactor for a 1000-MWe MHD power station. The kinetic model also describes the regeneration of the absorbent in the alkalized alumina process for removing SO2 from power-plant stack gases.

2499 APTIC NUMBER 20291

Fernandez, John Jane and Lawrence M. Justice
SELF-CLEANING SMOG CONTROL FILTER AND FIRE TRAP FOR INTERNAL COMBUSTION ENGINES. (Assignee not given.) U. S. Pat. 3,494,339. 5p., Feb. 10, 1970. 8 refs. (Appl. June 14, 1967, 9 claims).

An induction system for internal combustion engines which effectively reduces air pollution from the exhaust is described. The invention comprises a crankcase ventilating system and filter control mechanism which regulate the air-fuel ratio and eliminate any resenous gum or solid matter. This allows complete combustion of the fuel before the combustion products are exhausted to the atmosphere, and reduces any smog producing ingredients to a minimum. A filter and fire trap arrangement is included in the induction system which automatically maintains the gas and air ratio, and prevents any flame propagation due to engine backfire. The blowby filter, made up of relatively moveable interleaving wire coils, is connected to the engine crankcase. This filter and an air filter, connected in the carburetor induction system, recycle all gaseous fuels from the crankcase through the engine to eliminate all non-combustible matter from entering the exhaust manifold and being discharged to the atmosphere.

2500 APTIC NUMBER 20440

Pilstead, C. G., Jr.
CAMEL LNG PLANT: WORLD'S LARGEST. Hydrocarbon Process Petrol. Refiner, 44(7): 135-138, July 1965.

The CAMEL (Compangie Algerienne du Methane Liquide) natural gas liquefaction and storage plant at Arzew, Algeria, is described. LNG (liquefied natural gas) is shipped by sea from this installation to Canvey Island, England, and Le Havre, France. The plant has storage capacity of 447,000 barrels LNG, a rated daily production capacity of 45,288 barrels LNG, and was built at a cost of $87 million. The liquefaction process incorporates cascade refrigeration using steam turbine-driven centrifugal compressors. Construction, startup, and operation of the plant are reviewed, and operating problems are enumerated. The Canvey Island and Le Havre terminals are also described.

2501 APTIC NUMBER 21577

Pilstead, C. G. and Montgomery Banister
LOW-TEMPERATURE, LIQUEFIED-GAS TRANSPORTATION. Trans. Soc. Naval Architects Marine Eng., vol. 69:338-365, 1961. 26 refs. (Presented at The Society of Naval Architects and Marine Engineers Annual Meeting, New York, Nov. 16-17, 1961.)

The need for large ocean-going vessels carrying liquefied natural gas at low temperatures is becoming greater, and the economic factors governing the design of these vessels is far different than those used on ordinary tankers. The basic research and development work which culminated in the conversion of and successful operation of the MV METHANE PIONEER in low-temperature service is revieved. The factors which might influence the design of possible future vessels in this type of service are outlined. These features include the economic considerations of both terminal and marine facilities, competitive systems, and use of materials. Vessel considerations regarding hull shape and size, arrangement of cargo spaces for maximum cubic along with ballast requirements, design and construction of cargo tanks and holds, including insulating materials and tank penetrations are explored. The various systems necessary for safe and expeditious handling of the cargo, including liquid transfer systems, auxillary systems, gas-relieving and disposition systems, and the instrumentation necessary for these systems are covered. A review of special construction techniques to be followed is included. (Author abstract)

2502 APTIC NUMBER 21358

Finkl, C. W.
DUST AND FUME CONTROL IN A MODERN MELT SHOP. American Inst. of Mining, Metallurgical and Petroleum Engineers (AIME), New York, N. Y., Proc. An. Inst. Mining Met. Petrol. Engrs. Conf. Electric Furnace, 1956, vol 14:272-280.

A melt shop is described containing two 20-ton electric furnaces. Following the failure of roof ventilators and fresh air heaters to control dust and fume emissions, the shop adopted a control system consisting of furnace hoods and two separate dust collectors of six baghouses each. Each hood has three sections. The first section, over the charging door, contains a sliding companion flange, plenum chamber, and distribution damper. The center section has nonmagnetic stainless steel flappers around the electrodes to facilitate maintenance of the cooler rings and reduce the hysteresis losses in the hood. The front section has a slot for collecting fume from around the spout. Each hood requires 31,500 cfm at 4-in. water column suction. The dust collectors are assembled into one continuous unit 100 ft long, mounted on top of an adjacent building. Means are provided to vent fresh cool air into the baghouses if duct temperature reaches 275 F. Indications are that between 80 and 90% of the dust is collected by the hoods, which have also reduced the furnace noise output. However, hood life appears to be short, and the addition of hoods has had no effect on the oxidation of reducing slag. Smoke is still a problem during tapping and teaming. The dust collectors operate efficiently, and bag life is expected to exceed the guaranteed figure of two years.

2503 APTIC NUMBER 21674

Fiorello, S. C.
THE NAVY'S SMOKE ABATEMENT PROGRAM. SAE (Soc. Automotive Engrs.) Trans., 77(2):1051-1058, 1967. 12 refs.

Some of the present and proposed aircraft gas turbine engines emit large amounts of visible black smoke resulting from the incomplete combustion of hydrocarbon fuels. Significant factors that affect the amount of smoke produced are the type of fuel used, design of the combustion chamber, and operating conditions of the combustor. Smoke reduction is possible by the use of fuels with low aromatic contents and a higher hydrogen-to-carbon ratio. Although suppressant fuel additives are effective in reducing exhaust smoke from aircraft gas turbine engines, their use should be considered with extreme caution due to possible undesirable side effects. Low emission can best be achieved by proper combustion design: increasing the primary zone airflow; modification of the liner cooling air arrangement; new fuel pressure atomizing types; air atomizing or air assist types, and premix or vaporizing types of nozzles. Exhaust gas smoke emission was found to increase with increasing combustion pressure and heat input rate. For a constant heat input, the smoke decreased with increasing combustor inlet and exit temperatures.

2504 APTIC NUMBER 20305

Flanagan, Giulio
AIR FILTERING APPARATUS. (Gallone Engineering Co. Ltd., Mansfield, (England)) U. S. Pat. 3,495,381. 5p., Feb. 17, 1970. 11 refs. (Appl. March 4, 1969, 4 claims).

An electrostatic gas filtering apparatus which may be portable is described, comprising an ionizing and precipitator unit removably

arranged in a casing in tandem with a tangential flow fan unit. Gas is impelled first through ionizing means, where dust, smoke, or other particles therein are given an electrostatic charge, and then through precipitating means which attracts the appropriately-charged particles and removes them from the air. The ionizing section is constituted by a bank of paralled and alternating oppositely-charged plates and wires; a precipitating section is comprised of a pack of alternately oppositely-charged parallel plates which are disposed to provide air flow channels at right angles to the length of the plates and wires of the ionizing section. The fan unit includes at least one tangential flow fan arranged with its rotary axis and its air-impelling vanes parallel to the lengths of the air flow channels of the precipitator section.

2505

APTIC NUMBER 20571

Flegler, Eugen
THE INFLUENCE OF INTERMEDIATE LAYERS WITH INHOMOGENEOUS ELECTRICAL CONDUCTIVITY IN DISCHARGE GAPS WITH HIGHLY INHOMOGENEOUS ELECTRIC FIELDS UPON THE BREAKDOWN BEHAVIOR OF THE DISCHARGE GAP. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(7):18-24, July 1969. 12 refs.

The relationship between the separation efficiency of electrostatic precipitators and the charging of the combustion chambers arranged in front of them was studied. The cause of changes in separation efficiency was found by means of current-voltage characteristics recorded by simplified filter models and by breakdown voltage in the case of different types of electrode forms and model layers. Measurements with the simplified precipitator models confirmed that the separation efficiency of these devices is greatly reduced when the separated dust layers have a poor electrical conductivity and are largely inhomogeneous. In such layers, discharges can form at low voltages, leading to a subsequent breakdown of the gap between the dust layer and the discharge electrode at filter voltages markedly below the breakdown voltages of layers with higher electrical conductivity. (Author summary modified)

2506

APTIC NUMBER 21162

Fleming, J. B., R. J. Getty, and F. M. Townsend
DRYING WITH FIXED-BED DESICCANTS. Chem. Eng., vol. 71:69-76, Aug. 31, 1964. 15 refs.

The theory and practice of drying natural gas by using desiccants are discussed and an actual plant design is reviewed. Properties of four conventional desiccants are discussed and functional differences between equilibrium state and dynamic operation are presented. Variables in dynamic operation considered include gas saturation, temperature, pressure, flow rate, capacity requirement, and desiccant selection. The planning, design, and performance of the four-tower natural gas dehydration station at Liberal, Kan. is detailed as a case-in-point for the arguement presented. Dehydration of fixed-bed adsorption units is employed to control humidity in handling, packaging and storing materials; drying air in air fractionation plants; cryogenic applications; and utilization in petrochemical plants using feedstock gas as a raw material.

2507

APTIC NUMBER 20737

Flowers, George H. Jr.
APPARATUS FOR BURNING COMBUSTIBLE PRODUCTS IN EXHAUST GASES AND REMOVING FLY ASH THEREFROM. (Waste Combustion Corp., Mechanicsville, Va.) U. S. Pat. 3,489,109. 7p., Jan. 13, 1970. 2 refs. (Appl. July 9, 1968, 17 claims).

An incinerator is described for burning in large volume all types of rubbish or waste material, while the exhaust gases from the main combustion zone are subjected to another burning zone to insure complete combustion and to a zone for the removal of fly ash. It comprises a casing member defining a main combustion chamber and a passageway through the casing member for discharge of exhaust gases. A transition conduit communicates with the passageway for receiving exhaust gases, while there is a pressure burner for effecting a burning zone in the transition conduit. A second casing member defines a fly ash collection zone, and a baffle within the second casing member divides it into two chambers in communication with each other. The discharge opening of the transition conduit is positioned in one chamber, while a stack has an inlet opening in the other chamber. Forced air for the main combustion zone of the incinerator is supplied through holes in the casing member; the holes can be cleaned from the exterior of the incinerator. (Author abstract modified)

2508

APTIC NUMBER 20286

Flynn, Charles S.
AIR PURIFYING APPARATUS AND METHOD. (Assignee not given.) U. S. Pat. 3,497,308. 5p., Feb. 24, 1970. 4 refs. (Appl. July 22, 1968, 6 claims).

A combustion apparatus and method for burning waste fluids, particularly combustible vaporous and gaseous fluids from the kraft pulping processes, are described. A particular burner and manifold are employed in a stack. The burner permits hot combustion gas to flow past the manifold jets through which the combustible gases are ejected at a high velocity. The burner combustion gases extend over a large area using a refractory felt dissipator and combustion surface. The gases are sucked out of the generating vessel zone and forcefully discharged through the manifold jets adjacent to the burner at a velocity far exceeding the flame propagation rate of any of the combustibles, preventing flash-back into the kettle or other vessel. The gases thus pass to the atmosphere in a purified form. The details of the method, and the construction and arrangement of the equipment, are discussed.

2509

APTIC NUMBER 20769

Forsyth, Samuel E.
METHOD FOR SULFONATION OF HYDROCARBONS AND DISPOSAL OF GASES THEREFROM. (Phillips Petroleum Co., Bartlesville, Okla.)

U. S. Pat. 3,485,745. 4p., Dec. 23, 1969. 5 refs. (Appl. Dec. 27, 1966, 2 claims).

A method for hydrocarbon sulfonation and sulfur dioxide neutralization is described, as well as for spent caustic oxidation. The hydrocarbon is contacted in solution with liquid sulfur trioxide, and a large amount is converted to SO2. The SO2 is removed from the sulfonation zone and introduced by an eductor into a circulating stream of sodium hydroxide to produce sodium sulfite. At a pH of 8 or 9 the harmful sodium sulfite is oxidized by air to harmless sodium sulfate. The reaction rate for oxidation of NaSO3 to NaSO4 decreases rapidly for lower pH solutions. One important application of sulfonated hydrocarbons, particularly neutralized sulfonated asphalts, is used as additives for oil well drilling muds.

2510 APTIC NUMBER 21218

Frankenberg, Theodore T.
AIR POLLUTION FROM POWER PLANTS AND ITS CONTROL. Combustion, 34(8):28-33, Feb. 1963. (Presented at the National Conference on Air Pollution, Washington D. C., Dec. 10-12, 1962, Paper H-4.)

The progress in the control of air pollution from power plants during the period 1958-1962 is reviewed. Two continuing problems are identified as the economic removal of sulfur from coal and sulfur dioxide from stack gas and the economic control of nitrogen oxides. Major emphasis of present and future control efforts is on the use and design of high stacks. While the high concrete stack accomplishes its functions, sulfate attack on the concrete has resulted in some of the stacks built since 1954. Principle new problems facing the industry are identified as the shift to larger individual generating units and the installation of greater numbers of these larger units at a single site. In prepared discussion, the responsibility of the Bureau of Mines to develop the tools for the control of sulfur and nitrogen oxides is brought out, and its efforts in that direction specified. Since, without exception, all costs of air pollution control are reflected in the consumer's bill for service, the responsibility of both the industry and those who would promote arbitrary regulation to consider the value to the community of each control is emphasized.

2511 APTIC NUMBER 21082

DUST SEPARATION AND DESULFURIZATION OF FLUE GASES BY THE BISCHOFF-PROCESS. (Die Entstaubung und Entschwefelung von Rauchgasen nach dem Bischoff-Verfahren). Preprint, 5p., 1968. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 7p., Oct. 14, 1969.

The Bischoff method is an adjustable wet process which operates with alkaline additives to remove dust and sulfur dioxide from flue gas in a single operation, and therefore gives savings in space and costs. The final sludge which accumulates can either be disposed of, used to manufacture construction blocks, or roasted for use in sulfuric acid production; in the latter case, the additive is partly recovered. Preliminary cleaning in a dry mechanical dust collector is helpful if the fly ash contains a great deal of incombustible substances and/or when the dust concentration is very high. Results of pilot operation in a coal-fired boiler furnace showed that dust can be removed far below 100 mg/cu m; fine dust particles that remain in flue gases with other methods were also removed successfully. With an additive injection of 10% more than the stoichiometric amount, 80 to 90% of the sulfur could be removed from a flue gas with a concentration of about 2.5 to 3.0 g SO2/cu m. At higher SO2 concentrations, the ratio between desulfurization and injected amount of additive becomes more favorable. A plant for the Bischoff process comprises the following equipment: (1) storage and dosing facilities for storing and injecting the pulverized calcium-containing additive into the flue gas; (2) a two-stage scrubber consisting of pressure zones and annular slot scrubbers, water separator, and pneumatic dashpot; (3) a blower, equipped with adjustable guide vanes; (4) scrubbing water recirculation facility; and (5) a device for sludge dehydration, the type depending on the particular needs of the operation.

2512 APTIC NUMBER 20526

Fukuma, Shin-ichi and Kazumi Kamei
DRY-SYSTEM FLUE GAS DESULPHURIZATION PROCESS (DAP-MN PROCESS) FOR SO2 REMOVAL. Jap. Chem. Quart., 4(3):12-14, July 1968.

The dry-system flue gas desulfurization process employes activated manganese oxide as absorbent. Ammonium sulfate is obtained as by-product. A semicommercial plant capable of treating gases from a 55MW power plant equivalent to 150,000 cu m was constructed and first results on its operation were obtained. The gas which is being cleaned contains 0.1% by volume sulfur dioxide, 3.3% oxygen, 9.2% water, 11.9% carbon dioxide, 75.5% nitrogen, and 100 to 200 mg dust/cu m. It enters the desulfurization plant with a temperature between 135 and 150 C. Diffusion of activated manganese oxide powder in the gas and its transportation by the gas stream was satisfactory. A SO2 removal rate of 90% was obtained at a consumption of 150 to 250 g/cu m of absorbent. A constant absorption efficiency could be maintained over an extended period. The absorbent has good electric properties so that it is easily collected by an electrostatic precipitator. The total dust removal efficiency was 99.98%. The total pressure loss was below 100 mm water. The plant has three stations: the SO2 removal station; the absorbent regeneration station; and the by-product treatment station. In the first station, the absorbent reacts with SO2 and SO3 in the gas stream by forming manganese sulfate. This and unreacted active manganese oxide are collected in a multicyclone and electrostatic precipitator. At station 2, air (5 kg/sq cm) is blown into the manganese sulfate solution and ammonia water is added. At station 3, the ammonium sulfate solution is crystallized. Operating costs amount to 1.00 dollar per ton of fuel oil.

2513 APTIC NUMBER 20670

Furkert, Herbert
METHOD OF RECOVERY OF SULPHURIC ACID. (Chemiebau Dr. A. Zieren G.m.b.H. and Co. K. G., Cologne-Braunsfeld (West Germany)) U. S.

Pat. 3,490,868. 5p., Jan. 20, 1970. 4 refs. (Appl. March 4, 1968, 6 claims).

Sulfuric acid is produced from sulfur dioxide-containing gases by a multi-stage catalytic oxidation process and a two-stage sulfur trioxide absorption. The first absorption stage is arranged before the last oxidation stage and the second absorption stage is arranged after the last oxidation stage. Sulfur trioxide-free exhaust gas leaving the first absorption stage is reheated to the starting temperature for the last oxidation stage with superheated steam. The steam is obtained from an exothermic step of the overall sulfuric acid recovery process starting with a sulfur-containing raw material. (Author abstract)

2514 APTIC NUMBER 21696

Furkert, Herbert
THE CLEAN AIR PROCESS. (Das Reinluft-Verfahren). Text in German. Chem. Ind. (Duesseldorf) 22(5):291-295, May 1970. 2 refs. (Paper presented at the 32nd Annu. Power Conf., Illinois Inst. of Technology, Chicago, 1970).

In the Reinluft process, sulfur dioxide and oxygen are adsorbed by carbon containing porous catalysts such as low-temperature coke. At temperatures between 50 and 160 C sulfur trioxide is formed which is hydrated to sulfuric acid. The loaded adsorbent is heated to 400 C and the water is evaporated. Sulfur dioxide and carbon dioxide are obtained as reaction products through the reducing action of carbon. They are removed from the adsorbent surface by scavenging gas. Not only SO2 can be removed but also halogenated hydrocarbons with the Reinluft process. Fly ash in the gas does not reduce the activity of the adsorbent. The first experimental plant operating according to this method has been built in Wolfsburg. At operating temperatures between 70 and 160 C the gas was 99% desulfurized. The second Reinluft plant was installed in a copper smelting plant. Gases with 0.1 to 0.3% by volume SO3 were desulfurized with 70 and 85% efficiency at temperatures between 100 and 130 C. Use of this process for cleaning waste gases from a Claus furnace was abandoned because of fires.

2515 APTIC NUMBER 21231

Gardner, Frank J.
BIG NG COMPLEX TAKING SHAPE. Oil Gas J., 65(17):64-66, April 24, 1967.

The world's largest gas liquefaction plant is in Port Marsa el Brega, Libya. Scheduled to begin operation in October 1968, the 200 million dollar facility will supply the gas market in Spain and Italy. This is the first associated gas to be exported in liquid form. Principle source of gas will be Esso's Zelten oil field, which is 110 miles south of the plant. Transition from gas to liquid is done in three steps: compressing; treating and drying; and cooling. Storage will be in two 300,000 barrel insulated tanks.

2516 APTIC NUMBER 21235

Gardner, M. B., Jr.
PRESTRESSED PIPING SYSTEM FAVORED FOR LNG TRANSPORT. Oil Gas J., 66(14):179-183, April 1, 1968. 6 refs.

A prestressed piping system can solve the problem of contraction, a major design consideration in transporting liquid natural gas (LNG). Physical properties of suitable materials are maintained or improved at cryogenic temperatures. The system for piping LNG would consist of an inner-insulated thin-walled conveying pipe and an outer pipe or casing of coated and wrapped pipe. Factors in determining the stress are heat treatment, thermal coefficients, and prestress. The inner pipe can be prestressed either thermally or with a hydraulic jack, but either way it must be anchored at intervals. Materials such as aluminum alloy 6061-T6, Type 304 stainless steel, and 9 percent nickel steel can be used. Turns and bends are no particular problem, although they should be minimized. Water is probably the best environment for a prestressed line because of its minimal annual temperature range.

2517 APTIC NUMBER 21589

LNG TRAVELS OVERLAND-FROM CALIFORNIA TO CANADA. Gas, vol. 43:118-119, April 1967.

The equivalent of 2.1 MMcf of gas was tapped from a liquefied natural gas supply in Chula Vista, Calif., and transported 1500 miles to Vancouver, British Columbia, in two insulated tank trucks which made two round trips each. After clearance from various regulatory agencies, the journey was made in 10 days. Truck tankers can be successfully used to supply customers whose pipeline sources have been interrupted or to supply outlying communities before load growth is sufficient to support pipeline construction. LNG for peak winter demands is now being transported to a Canadian utility by truck from a liquefaction plant about 40 miles away. Cryogenic Enterprises considers that it can deliver LNG to domestic and commercial consumers in isolated communities at a price competitive with propane and probably stove oil.

2518 APTIC NUMBER 21567

OTHER LNG PLANTS UNDER CONSTRUCTION. Gas, 41(8):87-96, Aug. 1965.

Three liquefied natural gas (LNG) peak-shaving plants currently under construction are described. While all three utilize the cascade liquefaction technique, the two being built for utilities will have above-ground storage; the one being built for a pipeline operator will have the first frozen-earth storage tank built in this country. All are the result of the increasing total demand for natural gas and the temperature-dependent variations in the instantaneous demand.

2519 APTIC NUMBER 21559

OPERATION MUDPIE. Gas Age, vol. 128:43-46, 48, Nov. 9, 1961.

A frozen-earth process for storing liquefied natural gas at minus 258 F was demonstrated as both safe and practical. The process involves freezing the ground surrounding the area to be excavated, digging the hole, and then installing a vapor-tight-sealed aluminum roof over the hole, before filling with liquid. The demonstration hole was 20-ft in diameter and 20-ft deep, giving a capacity of 850 bbls of LNG. This is about the equivalent of 3,000,000 cu ft of methane in the gaseous state. Safety and lower cost are advantages claimed over above-ground storage.

2520 APTIC NUMBER 21565

ALUMINUM DOMES FOR FROZEN GROUND METHANE TANKS. Gas J., 331(5414):89-90, July 19, 1967.

Aluminum domes are used to cover frozen-ground storage tanks for liquid natural gas (LNG). The domes are constructed in place, after a preliminary framework fabrication is placed on the tank by cranes. The main criteria in the design and fabrication of the structure are the accurate calculation of every intersecting angle, the careful milling of the joint tenon cuts, and a close tolerance standard for the extruded rib sections. The loads from the ribs are taken by a stainless steel thrust ring, set into the concrete ring beam. A secondary stiffening system supports an expanded aluminum mesh lining to take a layer of insulation.

2521 APTIC NUMBER 21229

'FROZEN GROUND' STORAGE CONSTRUCTION. Gas J., 326(5354):174-177, May 18, 1966.

The first two 'frozen ground' storage tanks will be at Canvey Island terminal for Algerian natural gas. The construction method consists of pre-freezing an earthen cylinder to the required depth, excavating the unfrozen earth from inside, and covering the cavity with a gas tight roof suitably insulated. Leakage of gas between the roof and frozen ground is prevented by means of a stainless steel membrane imbedded in frozen sand and water. The base of the excavation is frozen to a depth of 25 ft with freeze tubes which circulate calcium chloride refrigerant. The main advantage of the system is that it can be designed to supply either very large quantities of gas for short periods or to even out the longer term seasonal variations.

2522 APTIC NUMBER 21570

NORTH THAMES HAS GAS STORAGE PLAN FOR CANVEY. Gas J., 325(5343): 233, March 2, 1966.

In a proposed British storage facility for natural gas, liquid methane will be poured into two underground pits, each about 130 ft deep and 130 ft in diameter. The ground around the pits will be frozen to act as a natural insulator. Safety regulations will require that each hole be located 100 ft away from the nearest building. The liquid methane would be transported in tankers for frozen storage in this manner, helping to cope with sudden peaks in winter demand.

2523 APTIC NUMBER 21524

FROZEN GROUND STORAGE. Gas World Gas Coke, vol. 159:678, May 30, 1964.

A frozen ground storage facility for liquid methane, under construction at Arzew, Algeria, is briefly described. It is designed to contain 240,485 U. S. barrels at a temperature of -164 F and having a specific gravity of 0.416. Freeze tubes were installed in three concentric rings of holes drilled for circulating calcium chloride brine at -25 C, forming an ice wall about 20 ft deep and 10 ft thick. After excavation and testing, filling will begin and the circulation of the cooling medium can be discontinued, as the cold necessary to maintain the ice wall will then come from the evaporation of the stored methane. The excavation will be 120 ft deep. Advantages of this method are lower container and maintenance cost, greater safety, and less storage area.

2524 APTIC NUMBER 21592

GROWTH PROSPECTS FOR SEA TRANSPORT OF LIQUID GASES. Gas World Gas Coke, 165(4310):358, March 25, 1967.

The recent formation of two new companies will speed up the development of refrigerated tankers to carry liquefied natural gas (LNG) by sea. The companies are concerned with ship design and with licensing third parties for ship construction. Many countries around the world will be importing LNG in the near future. The two biggest markets at present are Japan and South America. The projected increase in demand of LNG has lead to an increase in the size and number of tankers. Future technology may make it possible to transport a wider variety of liquefied gases.

2525 APTIC NUMBER 21569

LIBYA TO HAVE WORLD'S LARGEST L.N.G. PLANT. Gas World, 163 (4258): 405, March 26, 1966.

A liquefaction plant is described that will, when completed, be capable of liquefying up to 380 mscf of natural gas per stream per day. Aluminum coil-wound heat exchangers will provide more than a million sq ft of surface and operate at temperatures down to -265 F. Basically, each exchanger will consist of a central mandrel with coils of tubes wound in parallel, headers for manifolding the tubes, and an external shell. Cost of the

approximately 2000 miles of tubing will represent the major part of the 10 million dollars to be spent on the liquefaction plant.

2526 APTIC NUMBER 21525

NATURAL GAS STORAGE AT CANVEY ISLAND. Gas World Gas Coke, vol. 159:840, March 28, 1964.

The materials and construction of five liquid methane storage tanks being built at the Canvey Island terminal in the Thames Estuary are described, to receive liquid gas from North Africa. Aluminum alloy was chosen for the storage tanks, pipelines, and ancillary equipment due to its advantages in relation to cost for low-temperature applications. It maintains its strength at -150 F, while having resistance to shock loading corrosion, and ductility. Other advantages include a high strength/weight ratio and ease of working. Each of the 4000-ton capacity tanks consists of an aluminum alloy interior shrouded by a 100-ft diameter steel casing, with heavy insulation in the air gap between the inner tank and casing. After each construction stage all welds were carefully X-rayed, and upon completion the tanks were pressure tested.

2527 APTIC NUMBER 21585

REFRIGERATED LPG TANKER. Gas World Gas Coke, vol. 159:143-144, Jan. 25, 1964.

A brief description is provided of the first European-built liquefied petroleum carrying tanker. Built in Sweden, the ship's cargo containers will have a total capacity corresponding to about 13,700 tons of propane (SG 0.58) or 15,800 tons of ammonia (SG 0.68). In addition, there are four horizontal cylindrical containers on deck, two on each side for the carriage of about 42,500 cu ft of liquefied chemicals under pressure and at ambient temperature. At the forward end of No. 1 hole there are two vertical cylindrical pressure vessels each of 2800 cu ft capacity. These vessels, which are not insulated, are intended for the storage of compressed liquid gas needed for pre-cooling the main containers prior to loading or after normal cargo is discharged.

2528 APTIC NUMBER 21543

THE PANHANDLE NATURAL GAS LIQUEFACTION PLANT. Gas World Gas Coke, vol. 161:505, April 24, 1965.

An unusual natural gas refrigeration plant has been erected in Kansas. It consists of a high pressure section and a cryogenic section. The latter is for the recovery of helium from what is a virtually unique system. The feed gas is cooled and compressed by a series of heat exchangers, distillation units, separators, and heat-pump compressors. One of the main difficulties in designing this plant arose from the peculiarity of the solubility of helium in methane during cooling; the solubility does not follow a 'straight line' but rises and then falls to a very low value.

2529 APTIC NUMBER 21555

THE PORT OF ARZEW GAS LIQUEFACTION PLANT. Gas World Gas Coke, vol. 160:650, 652-653, Nov. 28, 1964. 1 ref.

An Algerian liquefaction and storage plant will have the capacity to liquefy 150 million cu ft of natural gas per day. Of this, 100 million cu ft a day will be for the U. K. market and the balance, for France. The raw natural gas coming into the plant is dried, purified by the removal of CO2, and liquefied by reducing the temperature to around -258 F with steam-driven centrifugal gas compressors and heat exchangers. Operation of the plant is based on a cascade cycle, with two stages of propane, three stages of ethylene, and three stages of methane refrigeration. After treatment and initial cooling with propane, the feed gas is divided into three separate streams for the remainder of the liquefaction process. The plant will have three conventional aboveground storage tanks, each holding about 4600 tons. Two of the tanks will have an aluminum inner shell, the third a 9% nickel steel inner tank. All three will be provided with perlite insulation and a steel outer shell. There will also be a frozen-ground storage cavity about 114 ft deep and 122 ft in diameter.

2530 APTIC NUMBER 20641

Gatsis, John G.
HYDRODESULFURIZATION OF ASPHALTENE-CONTAINING BLACK OIL. (Universal Oil Products Co., Des Plaines, Ill.) U. S. Pat. 3,501,396. 4p., March 17, 1970. 4 refs. (Appl. April 14, 1969, 3 claims.)

A process for hydrodesulfurizing an asphaltene-containing black oil is described. The black oil is admixed with from 2.0% to 30.0% by weight water, and the resulting mixture reacted with hydrogen in contact with an acidic catalyst. The catalyst consists of 0.2% to about 10.0% by weight of nickel and about 1.0% to 20.0% by weight of molybdenum combined with an alumina-silica carrier material. The desulfurizing conditions include a temperature from above the critical temperature of water to about 800 F, a pressure within the range of 1000 to 2500 psig, and a liquid hourly space velocity from 0.5 to 2.0. The resulting black oil has a reduced sulfur content and a lesser quantity of asphaltenes. The total product effluent from the reaction zone is passed into a suitable separator where the liquid hydrocarbons are recovered, while the hydrogen-rich gas phase is returned to the reaction zone. This gas stream may be treated for the removal of ammonia and hydrogen sulfide. The liquid hydrocarbon product may be introduced into a stripping or fractionating column to remove dissolved gaseous hydrocarbons.

2531 APTIC NUMBER 21698

Gerth, Gerhard

DUST TECHNOLOGY. (Staubtechnik). Text in German. Z. Ges. Tech., 112(10):653-656, May 1970. 34 refs.

A brief review of 34 articles on dust technology is given. Tests with polyvinylchloride filters yielded collection efficiencies of 95% and 99% (double filter). Mention of an article is made in which wind sifters are classified according to the effective force. Study of the importance of metal dusts in manufacture of the asbestos textiles revealed that the metal content in the ambient air increases with decreasing size of asbestos fibers. Articles dealing with konimeters, impactors, particle counters, photometric dust measuring units and gravimetric dust collectors are enumerated. Impacters with square nozzles were found to have greater advantages than those with round nozzles. Articles describing the development of venturi scrubbers, mechanical dust separators, and important separation methods are mentioned. A supplement to the Law for the Prevention of Emission issued in North Rhine Westphalia has come out and a booklet explaining the regulations by the Federal Health Department concerning monitoring of emissions has been published. Several articles dealing with dust explosion and dust fires are mentioned. Important findings of these articles are that the flammability increases with diminishing grain size; ignition temperatures are higher with larger grains; the maximum explosion pressure, the explosion temperature and the fraction of the combustion products are proportional to each other.

2532 APTIC NUMBER 20490

Gibson, C. J.
FEASIBILITY OF LARGE SUPER-INSULATED PIPELINES FOR TRANSPORT OF LNG. Institute of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 2p. (April 7-12, Session no. 6, Paper 41.)

Liquefied natural gas (LNG) storage has been limited to facilities relatively close to seaports, but demands of metropolitan and industrial users point to inland facilities and continental transmission of LNG. Studies indicate that a pipeline system composed of pumping and refrigeration stations with a thermal protected pipeline is technically feasible. The pipeline would be composed of an inner pressure carrier, and an outer jacket would be required for protection of the inner line insulation system, vacuum retention, and thermal and geodic motion. Construction materials would depend on performance requirements as well as ease of pipeline fabrication and field installation. Low expansivity alloys have proved very practical in transfer of cryogenics, but moderate or high expansivity materials appear to be more economic. (Author abstract modified)

2533 APTIC NUMBER 20412

IMPROVEMENTS OF SEPARATING GASES FROM EACH OTHER. (Perfectionnements a la separation des gaz entre eux). Text in French. (Girdler Corp., Louisville, Ky.) French Pat. 685,992. 3p., April 7, 1930. (Appl. Dec. 3, 1929, 4 claims).

A procedure is presented for separating carbon dioxide, sulfur dioxide, hydrogen sulfide, and other acid gases (that is, those having an acid reaction or whose aqueous solution is an acid) from gas mixtures according to which the gas mixture is brought into contact with an absorbent nitrogenous organic base during the absorption stage and the absorbed gases are separated from the absorbent by heating it in the regeneration stage. By the use of two reaction chambers, a continuous cyclic operation of the gas separator can be realized. Among the nitrogenous organic bases used as absorbents, those whose carbonates are decomposed by heating offer many advantages, especially substitution compounds of ammonia and particularly, products of substitution of alcohol radicals into the ammonia of ammoniacal bases. It is preferable to use triethanolamine, although other compounds such as diethylamine, ethylamine, phenylhydrazine, dihydroxypropylamine, nicotine, hydrazine hydrate, diethylaminoethyl alcohol, piperidylethanol, etc. can be used. Triethanolamine can be used in its pure state of a viscous liquid or in (for example, aqueous) solution; it is easy to handle, not caustic, and can be used in apparatus made of ordinary materials. Its volatility is very small and it can be used at ambient pressure and temperature. The rate of its regeneration is relatively high, and during regeneration, it releases all, or very nearly all, of the absorbed gas or gases. To separate CO2 from a gas mixture, the latter is absorbed by a nitrogenous organic bases under conditions resulting in the formation of a carbonate from which CO2 is recovered by heating to the temperature of water steam.

2534 APTIC NUMBER 20303

Glass, Adolph C.
AIR POLLUTION CONTROL DEVICE. (Assignee not given.) U. S. Pat. 3,495,385. 4p., Feb. 17, 1970. 11 refs. (Appl. Aug. 21, 1967. 8 claims).

A gas purifying device for an internal combustion engine is provided with an apertured helical pipe to deliver exhaust gases, extending for a portion of its length about the clean gas outlet pipe of the device, and a conduit to deliver decontaminating liquid from the device to the helical pipe. No significant back pressure is imposed on the exhaust gases, but impurities are separated effectively by a liquid absorption process. The energy of the exhaust gases is used first to entrain the liquid particles by a Venturi effect, and secondly to precipitate the liquid particles for re-use by centrifugal action. An auxiliary air intake is provided to cool the exhaust gases prior to injection of the absorption liquid. (Author abstract modified)

2535 APTIC NUMBER 21028

Goldschmidt, K.
PRACTICAL EXPERIENCES WITH WASTE GAS DESULFURIZATION PROCESSES IN INDUSTRY- CONCLUSIONS. (Praktische Erfahrungen im Bereich der Industrie- Schlussfolgerungen). Text in German. VDI (Ver. Dent. Ingr.) Ber., no. 149:133-139, 1970. 4 refs.

Practical experiences with desulfurization processes are discussed for combustion gases in plants. Experiments with additive

suspensions (7:3 water to solid ratio) revealed that the best results were achieved with hydrated quicklime. However, only 20 to 30% of SO2 was removed by addition of 1.5 - 2.5 times the stoichiometrically required additive in the favorable temperature range of about 1500 C. The same amount of desulfurization was achieved by injection of dry calcium hydrate at 1150 C. Analysis of the sludge accumulating in the Bishoff-process revealed that it can be safely dumped without posing any danger to the groundwater. Tests with the Reinluft process using low-temperature soft coal coke, a dust concentration of 100g/cu m and of 2.9g/cu m, and an SO2 content of 2.6 and 2.9g/cu brought a 73% and 66% desulfurization. The Still process requires further modification to achieve any significant desulfurization. By wetting the catalyst a 70 to 80% desulfurization was achieved, but the catalyst consumption went up to 3 times the stoichiometrically required quantity.

2536 APTIC NUMBER 20500

Gourdine, Meredith C.
ELECTROGASDYNAMICS. Sci. Technol., no. 79, 7p., July 1968.

Application of the interaction between an electrically charged gas and an electric field is discussed in the case of an electrogasdynamic generator which converts the energy of fluid motion directly into electricity. In its most elemental form, high-speed gas enters a nonconducting channel and electrons are stripped off by the corona effect of the two highly charged electrodes at the mouth of the channel. The charged gas is then pushed 'uphill' against the electric field between the corona electrode and the collector electrode, and in so doing, it loses kinetic energy which shows up as electricity at the output terminals when the electrons are reunited with the gas at the collector. A number of requirements must be met to build an efficient EGD generator: the energy conversion channel must be a slender tube, and there must be several stages of these tubes in series for efficiency; the gas must flow at subsonic velocity and be seeded with very small particles; density must be as high or higher than normal atmospheric density; and temperature must not be so high that the insulating channel walls leak charges. Frictional losses must be taken into account, as well as the effect of field intensification due to charged particles and losses due to upstream drift. A variation of an electrostatic spray gun is described which can produce charged aerosols at a rate several orders of magnitude higher than any other method, without producing ozone or using dangerous radioactive isotopes. If contaminated air were used as the input gas for the aerosol sprayer, and if the charged gas were sprayed into a large chamber whose walls were kept at ground potential, the result would be a device for cleaning air.

2537 APTIC NUMBER 21393

Gran, A.
DEVELOPING, BUILDING, AND OPERATING AN LNG UTILITY SYSTEM: IS IT FEASIBLE? Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG 1st, Chicago, Ill., 1968, 7p. (April 7-12, Paper 2-6).

The development of the first liquefied natural gas utility system and the financial and technical problems encountered in promoting and building this system from infancy are described. As it was difficult to convince financial institutions that a new industry showed great potential, and to get suppliers to quote realistic prices, Cryogenic Enterprises found it necessary to build a pilot plant which would supply the community of Squamish with LNG. The liquefaction equipment was selected for simplicity and ease of operation and designed for future expansion at minimum cost to meet new market demands. Conventional nitrogen and oxygen equipment for transportation, storage and sendout was converted to LNG. The liquefier utilizes a dual pressure Linde cycle with provision for a precompr[illegible]. Gas is reduced from line pressure to 300 psi, compressed to [illegible] psi, cooled in the counterflow exchanger and expanded firstly to 300, and secondly to 15 psi. The flash gases cool the incoming gas and are recycled in two compressors. A build-up coil keeps pressure in the tank at the distribution pressure, and the ambient air heat exchanger converts LNG to natural gas. Instrumentation was found to be extremely important, not only that required for normal operation, but instrumentation to check and pinpoint malfunctions of individual components.

2538 APTIC NUMBER 20457

Gran, Anker
LNG ENTERS FOURTH STAGE OF DEVELOPMENT. Gas, vol. 43:41-43, June 1967. 1 ref.

Distribution of LNG (liquefied natural gas) from liquefaction plants to small, nearby communities is discussed. Distribution (the so-called 'fourth stage') by truck is cited as an example. The liquefier is based on a high-pressure system using the Joule-Thomson effect. The storage system consists of two storage tanks and a conventional double wall tank.

2539 APTIC NUMBER 20443

Guccione, Eugene
ON STREAM: LIQUEFACTION PLANT FOR SAHARA NATURAL GAS. Chem. Eng. vol. 71:182-184, Oct. 12, 1964.

The process flowsheet for the CAMEL (Compagnie Algerienne du Methane Liquide) LNG (liquefied natural gas) plant at Arzuv, Algeria, is presented and discussed. The plant has a liquefaction capacity of 1,943,000 gal/day. Purification of feed gas includes hydrogen sulfide removal by absorption with monoethanal amine; water is removed by condensation and collected with diethyleneglycol. Liquefaction is accomplished by three-stage cascade cooling utilizing propane, ethane, and methane refrigeration circuits.

2540 APTIC NUMBER 21176

Guepner, O.
SULFACID PLANTS FOR SO2 REMOVAL. (Sulfacid-Anlagen zur

SO2-Abscheidung). Text in German. VDI (Ver. Deut. Ingr.) Ber., no. 149:127-133, 1970.

The 'sulfacid' process is based on a wet catalytic oxidation of sulfur dioxide to sulfuric acid. Concentrations of less than 1.5% by volume of SO2 can be removed from waste gases. The sulfuric acid is washed out from the pores of the carbon containing catalyst by water, and the diluted acid obtained thereby contains 10 to 15% H2SO4. The gas to be cleaned enters the reaction chamber at temperatures between 60 and 80 C. For small gas quantities the reaction chamber is vertically arranged, for large quantities it is arranged horizontally. At present, seven plants are in operation with capacities ranging from 750 to 32,000 standard N cu m/h. The gases which they clean contain between 0.13 and 0.18% SO2 by volume. For field and laboratory experiments four experimental plants are available. Extensive tests have shown that the dust in the waste gases does not reduce the activity of the catalyst. Comparison of the pluses of gases cleaned by a dry process and by the wet 'sulfacid' process, in summer and winter time at unfavorable dispersion conditions revealed no differing pluse behavior. Of the seven large-scale plants in operation, four have reached and surpassed the guaranteed collection efficiency, while three fell short of the measure.

2541 APTIC NUMBER 20431

(Inventor not given.)
PROCEDURE FOR RECOVERY OF SULFUR DIOXIDE FROM A GAS WHICH CONTAINS IT. (Procede de recuperation d'anhydride sulfureux a partir de gaz en contenant). Text in French. (Guggenheim Brothers, New York) French Pat. 849,036. 8p., Aug. 7, 1939. (Appl. Jan. 17, 1939, 14 claims.)

A procedure for recovering sulfur dioxide from gases containing it is presented. The gases are treated by a liquid agent consisting primarily of dimethylaniline, so as to absorb the SO2 contained in them; the resulting absorption product is heated so as to liberate the SO2 which has been absorbed. The dimethylaniline is free of any diluting substance. The treatment of the gases by the absorbing liquid is carried out until a quantity of SO2 has been absorbed which amounts to at least 50 g/l of the absorbing liquid. After liberation of the SO2, the resultant product is subjected to the action of water vapor at an elevated temperature in order to release the absorbed SO2. The absorbing agent is treated by a solvent of the products of oxidation it contains in order to separate the oxidation products from the absorption products. After release of the SO2, the regenerated product is used to absorb new quantities of SO2. The solvent of the oxidation products is an alkali-metal sulfite. The gases are maintained in contact with the dimethylaniline until the SO2-content of the gases does not exceed about 0.50 volume % and, preferably, 0.10 volume %; the SO2 is recovered from the gases containing it by letting the gases bubble through one or several dimethylaniline baths. While the gases are in contact with dimethylaniline, the temperature is maintained at about 10 to 40 C; the release of absorbed SO2 is carried out at a temperature about 100 C and, preferably, at a pressure above atmospheric.

2542 APTIC NUMBER 20257

Gunn, D. J. and A. Saleem
ABSORPTION AND LIQUID-PHASE OXIDATION OF SULPHUR DIOXIDE. Trans. Inst. Chem. Engrs. (London), vol. 48:46-53, 1970. 10 refs. (Presented at a Symposium on Gas-Liquid Reactions of the North Western Branch of the Institution, Manchester, Jan. 21, 1969.)

The simultaneous absorption of oxygen and sulfur dioxide combined with liquid-phase oxidation of the SO2 was studied in a contactor packed with glass fibers. The interfacial area between gas and liquid was estimated by the absorption of carbon dioxide into solutions of sodium hydroxide. Although pronounced transient effects were observed, the experimental results supported the zero-order dependence of the reaction rate on oxygen concentration; but the dependence of the rate on SO2 concentration was positive and small under the experimental conditions. A steady state mechanism of diffusion and zero-order chemical reaction is described and analyzed. Because of the relative kinetics of diffusion and chemical reaction, the zone of reaction appeared to be confined to a surface film less than one thousandth of an inch thick. The reaction velocity constants from the absorption rates agree with other direct measurements of the chemical kinetics. (Author conclusions modified)

2543 APTIC NUMBER 20295

Gysi, Rudolf
COMPLETE SOOT-FREE COMBUSTION OF LIQUID FUEL. (Assignee not given.) U. S. Pat. 3,495,576. 6p., Feb. 17, 1970. 7 refs. (Appl. Sept. 11, 1967, 22 claims).

Liquid fuel is usually combusted by means of oil burners in which the oil is atomized by fine nozzles in an air stream and combusted in the same. However, complete combustion is never warranted. A system for soot-free combustion of liquid fuel, particularly heavy fuel oil, is described. Fuel is admitted to one wall of an evaporating canal, forming a thin film of fuel on the wall. A forced air flow is passed over the film at a high velocity. The temperature of the wall is at least equal to the evaporating temperature of all the constituents of the fuel, and the mixture of air and fuel is ignited at the exit of the evaporating canal. Under these conditions, a complete combustion, without production of soot and carbon monoxide, is obtained. The separation of the evaporation and combustion allows sufficient intermixing of the fuel and air for forming a homogeneous mixture, resulting in complete combustion. Preferably, the burner is operated with an appreciable air surplus.

2544 APTIC NUMBER 20430

Hale, Dean
'FROZEN EARTH' CONTAINER FOR LNG STORAGE. Am. Gas J., vol. 188:22-24, Dec. 1961.

A below-ground 20 ft diameter, 20 ft deep container for storing liquefied natural gas (LNG) at a temperature of -258 F and a pressure of 10 in. of water was constructed at Haynark Terminal near Lake Charles, La. General plans followed in the construction were as follows: 1) pre-freeze the ground surrounding the area to be excavated with an external refrigerant; 2) when the frost boundary has moved inward to the cavity-wall radius, start excavation (all excavation done by hand); 3) on completion of excavation, install the internally insulated aluminum roof; and 4) cool cavity walls slowly to avoid thermal shock by spraying with LNG, than fill. 1) was done by burying 'freeze pipes' to a depth of 10 ft in a 'freeze-pipe circle' of 14 ft radius and by circulating a refrigerant through these pipes; 2) was started when the frost boundary had moved 4 ft inwards, the frozen-earth barrier holding back the ground water (ground water level was 2.6 ft below ground surface at the site). Water seepage through the bottom of the cavity was very slight, due to a stratum of nonpermeable clay. The roof was sealed to the frozen ground and no gas leakage was detected. After filling the cavity with LNG, the boil-off rate was continuously measured and recorded, as were the isotherms in the soil surrounding the cavity. Ground heaving due to freezing did occur, but caused no structural or operational problems. The isotherm records showed a slow increase in thickness of the frozen-earth barrier with time. A 'vapor lift' or 'gas lift' system for pumping the LNG from the cavity has been installed at the Lake Charles facilities to determine the practicability of operating such a system.

2545 APTIC NUMBER 20512

Hale, Dean
SAN DIEGO LNG PLANT PUTS 'PRESSURE ENERGY' TO WORK. Am. Gas J., 193(1):30-34, Jan. 1966.

Operation of the San Diego Gas and Electric Co. LNG (liquefied natural gas) plant is reviewed. This facility utilizes molecular sieve purification, an isoentropic turbo-expander, and three-stage cascade refrigeration. The net delivery to the 620/MMcf double-wall above-ground storage tank is 2.0 MMcfd. A special feature is the use of a 250 psig pressure drop available from the supply gas to power the liquefaction process. Various considerations leading to the choice of an LNG plant over LPG (liquefied propane gas) are also reviewed.

2546 APTIC NUMBER 20444

Hale, Dean
SPECIAL AGJ REPORT: THE BIG FREEZE. Am. Gas J., 192(14):28-29, Dec. 1965.

The development of natural gas liquefaction and storage facilities is reviewed. Projects reported on (together with liquefaction, storage, and vaporization capacities) are: Wisconsin Natural Gas Co., Oak Creek, 1.00 MMcfd, 72,000 bbl, 50 MMcfd; Alabama Gas Co., Birmingham, 4.65 MMcfd, 175,000 bbl, 85 MMcfd; San Diego Gas and Electric Co., Chula Vista, California, 2.0 MMcfd, 175,000 bbl, 60 MMcfd; Memphis Light and Water Division, Northeast Shelby County, Tenn., 5 MMcfd, 300,000 bbl, 200 MMcfd; Brooklyn Union Gas Co., Greenpoint Works, Brooklyn, 2.0 MMcfd, 175,000 bbl, 60 MMcfd; Philadelphia Gas Works, Station B, Philadelphia, 16.8 MMcfd, 1,200,000 bbl, 400 MMcfd; Transcontinental Gas Pipe Line Corp., Carlstadt, New Jersey, 5.0 MMcfd, 300,000 bbl, 200 MMcfd; Tennessee Gas Transmission Co., Hopkinton, Mass., 18.5 MMcfd, 1,000,000 bbl, 248 MMcfd; and Texas Eastern Transmission Corp., Linden, New Jersey, 7.65 MMcfd, 600,000 bbl, 198.905 MMcfd.

2547 APTIC NUMBER 21204

Hals, Finn A.
ENVIRONMENTAL POLLUTION CONTROL THROUGH MHD POWER GENERATION. Combustion, 41(11):27-29, May 1970.

In addition to offering advances in power technology of significant benefit to society, magnetohydrodynamics (MHD) shows promise of solving serious air and thermal pollution problems faced by steam-electric power plants. The use of MHD-steam power plant could significantly reduce thermal pollution of water since, due to higher efficiencies, less than half the amount of cooling water used by conventional fossil-fueled steam power plants would be required. Since the supplemental steam turbine can be replaced with a supplemental gas turbine, MHD generators can be designed to reject all heat into the atmosphere and none to water. With no cooling water necessary, MHD generators can be located in water-poor but fuel-rich areas, opening them to industrialization. Particulate emission would be controlled by careful electrostatic precipitation, since the economic operation of the plant requires the recovery of an alkali seed impurity added to enhance electrical conductivity of the combustion gases. Particulate removal in excess of 99% is, therefore ensured. The temperatures at which MHD generators operate make the recovery of nitrogen oxides and sulfur oxides in the form of nitric and sulfuric acid technically feasible and economically attractive.

2548 APTIC NUMBER 20277

Hamilton, William F. and Eli Simon
ATMOSPHERIC POLLUTION CONTROL. (Lockheed Aircraft Corp., Burbank, Calif.) U. S. Pat. 3,499,723. 4p., March 10, 1970. 4 refs. (Appl. May 4, 1967, 2 claims).

A method of reducing smog-type atmospheric pollution by placing an iodide compound within visibly illuminated air is discussed. The compound may be placed in the air by being sprayed from a solution to form a mist. The solvent should be water, ethyl alcohol, or a mixture of the two. Preferably, an iodide solution is used which has been chemically stabilized so that it will not deteriorate before it is used. Such a solution may be of an aerosol type. (Author abstract modified)

2549 APTIC NUMBER 21229

Hanke, Carl C.
ABOVEGROUND STORAGE OF LNG IS SAFE AND PRACTICAL. Oil Gas J., 64(6):76-78, Feb. 7, 1966.

Aboveground, low-temperature storage has been proven safe for the liquefied natural gas (LNG) industry. Keys to successful large-quantity storage of LNG are (1) selection of material and design for the inner tank, and (2) design of the insulation system. The three materials available for service at LNG temperatures are aluminum, stainless steel, and 9% nickel steel. Specific design of a double-walled tank is based upon the required capacity, pressure, temperature, liquid density, and desired heat gain. Prime advantage of abcveground storage in double-wall metal tanks is the ability to design an insulation system for predictable, reliable, and economical performance. The ability to select almost any site is another virtue. Construction calls for extreme attention to details, especially welding. On completion, the tank is subjected to a series of overload tests to insure integrity and leak tightness.

2550 APTIC NUMBER 21588

Hanke, Carl C. and H. T. Marshall
BOSTON GAS LNG FACILITY BOASTS LARGEST EXPANDER CYCLE, PRETREATMENT SYSTEM. Am. Gas J., 195(7):42, 47-48, 50, June 1968.

A new peak shaving facility for liquefied natural gas will incorporate a number of unique features, among them a storage tank with carbon steel outer wall designed for 1.5-psig internal gas pressures. This design will enable the facility to operate on absolute pressure, thus minimizing effects on liquefaction and boiloff rate caused by barometric changes. The inner shell will be provided with a suspended insulating deck, not vapor-tight, which serves as a thermal barrier permitting methane boiloff to permeate the insulated area between the shells. A dual-expander liquefaction cycle, in which two expanders will be operating in parallel, will increase operating efficiency by a better range of control and turndown capability. The pretreatment system features a five-bed molecular sieve to remove water and carbon dioxide from incoming gas, while the entire feed stream will have its moisture content reduced by passing through a two-bed dehydrator. One dehydrator bed will be absorbing moisture while the other bed is being regenerated by the passage of three molecular sieve absorber vessels. With this type of system, regeneration times are lengthened and the total heat requirement is minimized. A special dehydrator regeneration gas retention system is provided to reduce and stabilize sulfur releases from the pretreatment system.

2551 APTIC NUMBER 21223

Hanke, Carl C.
CRYOGENIC TANKS ARE IMPROVED. Oil Gas J., 66(44):77-79, Oct. 28, 1968.# (Presented at the American Gas Association Distribution Conference, Houston, Tex., 1968.)

The current and predicted usage of flat-bottom double-wall cryogenic tanks is presented. There are 38 metal liquefied natural gas storage tanks on a worldwide basis. Reasons for their selection and trade-off parameters to be considered are reviewed. Boil-off loss rates and insulation cost figures are used to support the claim of increased economy of operation. The recently developed suspended deck insulation concept is described and its advantages listed. Advances in the control of piston action in the perlite insulation by the use of resilient glass-fiber blankets are described. Mention is made of the appendix to American Petroleum Institute Standard 620 which provides a uniform design base for above-ground liquefied natural gas tanks.

2552 APTIC NUMBER 21048

Hardison, L. C.
TECHNIQUES FOR CONTROLLING THE OXIDES OF NITROGEN. J. Air Pollution Control Assoc., 20(6):377-382, June 1970. 10 refs.

There are several systems in wide use for controlling nitrogen oxides from specific chemical sources. These are limited to nitric acid production and processes using nitric acid as a reagent. Most modern plants employ a catalytic reduction technique to reduce the concentrations of oxides, reduce NO2 to NO, and heat the recovery stream for power recovery. This process requires a substantial fuel input, and allows significant emissions of colorless NO. This emission can be controlled only by increasing the quantity of catalyst and the amount of fuel by a factor of two over the conventional partial reduction technique The conventional catalytic system has several design criteria: color freedom (NO2 below the visible threshold); conversion of fuel high enough for economical operation; and sufficient temperature rise to secure design conditions at the inlet of the power recovery turbine. Each of these criteria is discussed in detail. In some areas, a two-stage system is required to remove all the oxygen from the stream to secure catalytic reduction of all the nitrogen oxides to nitrogen. The reduction of concentrated nitrogen oxides streams is also discussed.

2553 APTIC NUMBER 20589

Hass, G. C., Donel R. Olson, John W. Pattison, M. P. Sweeney, and Miles Brubacher
PRELIMINARY REPORT ON THE EFFECT OF COMMERCIAL TUNEUPS ON AUTOMOTIVE EXHAUST EMISSIONS. Scott Research Labs., San Bernardino, Calif., 12p., 1968 (7).

The effect on exhaust emissions of a general tuneup as done by private garages, dealers, service stations, etc. and of a specified tuneup as recommended by the Automobile Manufacturers Association was studied. The test cars were selected to be representative of the California car population. Each tuneup group consisted of 50 cars distributed over the years 1950-1963. First, an exhaust test was conducted on the car. Then it was sent out for tuneup and returned for the 'after tuneup' exhaust test. The cars were then returned to the owners with specific instructions for them to observe their normal maintenance habits during one year. The cars were brought back at intervals of 3, 6 and 12 months for exhaust

testing only. The reduction of exhaust emissions through both types of tuneup were minimal. If significant reductions in exhaust emissions are to be accomplished by engine maintenance, techniques and skills must be upgraded over present levels.

2554 APTIC NUMBER 21528

Hathaway, Paul L.
BUILDING AND OPERATING AN LNG PLANT. Instr. Control Systems, 41(1):109-111, Jan. 1968.

The four major functions of a liquefied natural gas (LNG) plant are cleanup or purification of the feed gas stream; liquefaction; storage; and revaporization. At a San Diego plant, cleanup is achieved by the use of 5000 lb molecular sieves. Instead of the cascade refrigeration cycle, the plant uses the 'expander' cycle in which the pressure available in the pipeline performs refrigeration work. Natural gas enters at 300 psia and passes through the cleanup section at this pressure. One portion, about 85%, becomes the refrigeration stream; the remaining 15% becomes the liquefaction stream. The refrigeration stream flows through the turbo-expander where the pressure is reduced to 60 psia. The cold effluent from the turbine is used in the heat exchangers to refrigerate the liquefaction stream. Warm vapors from the refrigeration stream are compressed for use as boiler fuel. At this point, the liquefaction stream is passed through an expansion valve for further cooling. After the vapor and liquid are separated, the liquid is delivered to double wall aluminum storage tanks. The plant, which is completely automated, has a liquefaction capacity of 2 1/2 million cu ft/day. Tank storage volume is 1,750,000 barrels of liquid. For revaporization, the maximum sendout capacity is being increased from 60 million to 120 million cu ft/day.

2555 APTIC NUMBER 20637

Hathaway, Milton S.
FILTER ASSEMBLY. (Assignee not given.) U. S. Pat. 3,494,111. 4p., Feb. 10, 1970. 9 refs. (Appl. June 2, 1967, 2 claims.)

A disposable air filter assembly for automobiles and the like comprises inter-fitted housing sections, between which polyurethane foam or similar filtering material is compressed. Both sections are made of heat-resistant thermoplastic resin or high-impact plastic. The upper housing section has a circular top wall and a frusto-conical side wall with circumferentially spaced indentations extending to points approximately two-thirds of the depth of the wall. The lower section has an annular base, from the inner edge of which a tubular element extends upward and from the outer edge of which an outer wall extends upward. From the upper edge of the wall, a flange extends horizontally outward, terminating in a flared skirt. The skirt is provided with embossments that correspond with the inner surface of the side wall of the upper section. The embossments form passageways of limited circumference for the air that passes through the filter and tubular element to a breather pipe of the crankcase ventilation system. The indentations on the side wall of the upper section control and direct the incoming air to the filter, thereby assuring uniform distribution of air through the filter. When the filter is no longer effective, the entire unit is quickly and easily removed for disposal. Disposal is feasible because of the relative inexpensiveness of construction materials and methods.

2556 APTIC NUMBER 20669

Hauser, John A.
HIGH PRESSURE GAS FILTER SYSTEM. (United States of America) U. S. Pat. 3,490,205. 6p., Jan. 20, 1970. 13 refs. (Appl. Nov. 30, 1967, 3 claims).

A system is described for purifying and filtering gases such as air and helium that have been compressed to a high pressure by oil lubricated compressors. The purification and filtering is accomplished by passing the gas through three sequential stages as follows: scrubbing towers, which contain gas impingement filling or packing such as Raschig rings, remove droplets and mists of oil and water; adsorption beds further remove mists of oil and moisture and also remove oil and moisture down to molecular size; felt filter elements extract oil vapors by depth filter action and filter any dust particles which may be generated by any agitation of the adsorption beds of stage two. The system has very high flow, holding, and pressure capabilities. (Author abstract)

2557 APTIC NUMBER 20360

Helden, Henricus J. A. Van, Jaap F. Naber, Frederik J. Zuiderweg, and Heinz Voetter
PROCESS FOR REMOVING SULFUR OXIDES FROM GAS MIXTURES. (Shell Oil Co., New York) U. S. Pat. 3,501,897. 7p., March 24, 1970. 6 refs. (Appl. Nov. 20, 1967, 12 claims).

A process is presented sulfur oxides from flue gas by a solid acceptor; the apparatus of the invention is arranged in such a way that the presence of particles in the gas does not result in the clogging and deactivation of the acceptor. The process comprises conducting a gaseous mixture through one or more open gas channels formed by one or more sheets of gas-permeable material and running parallel or substantially parallel to the outer housing. The acceptor is present in, on, and/or behind the channel walls and thus freely accessible to the gas mixture, which diffuses into the walls. While the sulfur oxides in the gas are accepted by the acceptor, any soot or ash particles in the gas pass through the channel, from the inlet to the outlet. Because of the parallel arrangement of the gas channels, a much smaller pressure drop is obtained than in a fixed or moving bed. The acceptor can be in any suitable form such as granules or large solid blocks. Preferred acceptors are alkali metal compounds, such as potassium oxide or sodium oxide, promoted with vanadium oxide or copper oxide catalysts. Suitable gas-permeable channel walls consist of metal or plastic gauze having a mesh size proportionate to that of the granular solid acceptor particles. The acceptance of sulfur oxides proceeds under oxidative conditions in the presence of oxygen at 300 to 450 C. The regeneration of the acceptor is effected by treatment with a reducing gas or gas mixture at similar or slightly higher temperatures.

2558 APTIC NUMBER 20318

Henry, Joseph Peter
PROCESS FOR RECOVERING THE AROMATIC VALUE OF SULFUR-CONTAINING STILL BOTTOMS FORMED DURING THE REFINING OF STYRENE. (Union Carbide Corp., New York) U. S. Pat. 3,501,545. 3p., March 17, 1970. 13 refs. (Appl. Dec. 27, 1968, 12 claims).

A process for the recovery of sulfur and aromatic values of sulfur-containing tars is discussed. The sulfur and aromatic values of sulfur-containing tars can be recovered by the simultaneous hydrodesulfurization and hydrodealkylation (hydrotreating) of such tars. In this process, the sulfur-containing tars are diluted with benzene or some other suitable solvent. The diluted tar is filtered to remove solid sulfur. The resulting filtrate is passed, with hydrogen, through a hydrotreating reaction zone. Essentially all the sulfur-containing tars are converted to lower-boiling, readily-recoverable aromatic compounds, such as benzene, ethylbenzene, diethylbenzene, and toluene. Almost all the sulfur is recovered as hydrogen sulfide.

2559 APTIC NUMBER 20723

Heredy, Laszlo A.
ELECTROCHEMICAL METHOD FOR RECOVERY OF SULFUR OXIDES. (North American Rockwell Corp., Canoga Park, Calif.) U. S. Pat. 3,479,261. 6p., Nov. 18, 1969. 3 refs. (Appl. May 15, 1967, 5 claims).

A sulfur removal process is provided, comprising the separate sequential stages of absorption using an alkali metal carbonate-containing molten salt and electrochemical regeneration using carbon dioxide and oxygen as cathodic feed material. In the absorption stage, sulfur oxides present in a hot combustion gas are removed from the combustion gas by contacting it at a temperature of at least 325 C with a molten salt mixture containing alkali metal carbonates as active absorbent. The resultant sulfur compound that is formed consists principally of alkali metal sulfite, derived from the sulfur dioxide, and may also contain alkali metal sulfate, derived from the SO3 initially present or formed by oxidation of a portion of the formed sulfite. For the electrochemical regeneration, the alkali metal sulfite and sulfate are converted to a mixture of SO3, SO2, and O2 gases in the anode compartment of an electrolysis cell. Carbon dioxide and a source of oxygen, preferably air, are fed to the cathode compartment to regenerate alkali metal carbonate for recirculation in the process. The gaseous mixture of SO2, SO3, and O2 is recovered as a suitable feedstock for a sulfuric acid plant. The electrochemical regeneration is performed at a temperature of at least 325 C at which the alkali metal sulfite-containing salt is molten.

2560 APTIC NUMBER 20746

Hermes, Walter L. and Charles Jones
EXHAUST GAS REACTOR. (Curtiss-Wright Corp., Caldwell, N. J.) U. S. Pat. 3,486,326. 10p., Dec. 30, 1969. 5 refs. (Appl. Feb. 27, 1968, 6 claims).

An improved system for oxidizing the exhaust gases of an internal combustion engine in an exhaust reactor is described. The inlet openings and baffle plates are symmetrically arranged with respect to the exhaust opening so that the same back pressure is produced in each inlet. An inner container forms a reaction chamber where the oxidation of unburned materials takes place, and it is mounted for movement in an encasing structure so that the container may expand and move relative to such structure when heated. A by-pass conduit conveys the exhaust gases from the reaction chamber to an exposed portion of the intake manifold, and from the intake manifold to an exhaust pipe connected with the container.

2561 APTIC NUMBER 21273

Herwert, George L.
HYDROCARBON VAPOR CONTROL MEANS FOR USE WITH ENGINE CARBURETOR. (Universal Oil Products Co., Des Plaines, Ill.) U. S. Pat. 3,477,210. 4p., Nov. 11, 1969. 6 refs. (Appl. Aug. 12, 1968, 4 claims).

An improved hydrocarbon sorbent-air filter system for use with a carburetor to prevent hot soak fuel losses is described. This filter, when used in the inlet section of a carburetor for an internal combustion engine, traps hydrocarbon vapors during the idling period so that they are not released to the atmosphere. The sorbent-filtering device consists of a fibrous matrix, such as a mat, filtering paper, or felt, and a hydrocarbon sorbent material such as activated carbon particles. Desorption of the vapors is effected by an incoming air stream flowing to the carburetor during high engine speed periods. (Author abstract modified)

2562 APTIC NUMBER 20472

Hicks, R. E. and W. G. B. Mandersloot
FLEXING FATIGUE OF GLASS-FIBER FILTER CLOTH. Textile Res. J., 38(9):942-950, Sept. 1968. 22 refs.

A quick, comparative, flexing endurance test using a modification of ASTM D643-43 for paper was developed to evaluate glass filter cloth for specific high-temperature filtration applications; various makes of cloth were tested new, after heat exposure, and after use in a bag house. High-temperature operating conditions were simulated by heat exposure in a laboratory oven to 500, 550, and 750 F. Good flexing endurance, when new, is not necessarily maintained after exposure to heat. To avoid a large scatter in the results, a flexing angle of over 150 deg. should be used. Sharp jaws (r equals 0.015 in.) appear to give consistent results at all flexing angles. The log of mean life is inversely proportional to the flexing angle, which is explained by considering flexing angle (proportional to the length of that part of the specimen being flexed) as an equivalent of specimen length in axial-stress cycle fatigue. In one type of cloth which was

tested extensively, the distribution of life was log-normal for the weft (texturized yarn) and bi-modal log normal for the warp (continuous filament). During flexing, these yarns give different elongations of the specimens. Considerable bag-to-bag variations were found, and, as is usual with textiles, large numbers of specimens must be tested before the results are representative for a batch of bags. For bag filter operation, not only the mean life, but also the life distribution is of consequence, which, again, requires the testing of a large number of specimens. (Author conclusions modified)

2563 APTIC NUMBER 20392

Higashi, M., S. Fukui, and K. Kamei
STUDY AND EXPERIENCE OF MHI ON THE LIME PROCESS FOR SO2 REMOVAL. Preprint, 12p., 1967. 4 refs. (Presented at the Third Limestone Symposium, Clearwater, Fla., Dec. 4-8, 1967.)

A pilot plant and an industrial plant using lime and slaked lime for the removal of sulfur dioxide are described. The pilot plant comprises a spray tower, a grid packed tower, a venturi scrubber, and an MHI (Mitsubishi Heavy Industries) cross flow absorber. The flue gas from the oil-fired boiler is conducted to the spray tower and cooled to about 55 C (130 F). It then passes the three kinds of absorbers arranged in a line. The gas contains 0.15% by volume SO2 and 0.0015% SO3. Limestone slurry, chalk lime, and slaked lime were tested as absorbents. The reaction formula of the Lime Process is as follows: CaCO3 +SO2 +2H2O yields CaSO3.2H2O + CO2; Ca(OH)2 +SO2 +H2O yields CaSO3.2H2O; and CaSO3.2H2O +1/2 O2 yields CaSO4.2H2O. The SO2 absorption ratio depends on the absorbent. All impurities in the by-product are from the raw material; hardly any are from the flue gas dust because the latter is almost completely retained in the spray tower. Venturi scrubbers have a large power consumption. Grid packed towers and MHI Cross flow absorbers are well suited for the process. The Grid Packed Tower is better for handling the slurry. The industrial plant using the lime process has a capacity of 63,000 cu m/h. The SO2 content of the gas is 0.3% by volume in the unclaimed gas; in the cleaned gas, it is 0.03%. Gypsum is recovered; carbide sludge is used as absorbent.

2564 APTIC NUMBER 21379

Hines, Edward, Matthew S. Mashikian, and Laurance J. Van Tuyl
EFFECT OF ELECTRIC VEHICLES ON THE POWER INDUSTRY. Preprint, Society of Automotive Engineers, Inc., New York, 4p., 1969. (Presented at the Society of Automotive Engineers, Mid-Year Meeting Chicago, Ill., May 19-23, 1969. Paper 690441.)

Given the state of development of electric vehicles, the capability of the power industry, and the availability of off-peak power, it is felt that development of the electric vehicle market will be very gradual with minimum disruption of the automobile industry, the electric power industry, the petroleum industry, or their suppliers. Under most favorable conditions to the power industry, not more than 100 billion kWhr of additional load should be expected before 1985. A considerable percentage of the cost of electric power comes from capital investment in generation, transmission, and distribution equipment which is sized for the maximum load that must be [illegible], and a large part of this equipment is idle on off-peak [illegible] during the hours between 11 PM-6 AM. It is [illegible] that the storage system of the electric vehicle will be [illegible] off-peak, overnight in the owner's residence, and one [illegible] the establishment of a reduced rate for this time. [illegible] to 5 kw (10-hr rate), power distribution [illegible] could presently accommodate the load in the [illegible] electric heaters; but short-time, [illegible] battery recharging, are not desirable [illegible] system. Mechanical recharging of batteries [illegible], by which the anodes will be recharged outside the vehicle at central locations [illegible] gasoline service stations.

2565 APTIC NUMBER 20652

Hishida, K.
CONTROL OF LEAD CUPOLA FURNACES FROM VIEWPOINT OF SMOKE PROPERTIES. (Kamari saiseiren sagyo ni tomonas haien no seiji to taisaku). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(3):81, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Smoke that accompanies lead refining contains complex dust particles. Lead scraps from dry-cell manufacturing are fused in the cupolas and the resulting crude ingots are refined into 97 - 98% purity by means of a kiln. Most of the dust particles originate from the bakelite (phenol formaldehyde) and glass fibers in the cupola fusion. An investigation was conducted on the characteristics of the dust particles, the elimination of which was attempted in a plant with two cupolas, one kiln, a cyclone scrubber, and a 23 meter high chimney. The quantity of dust particles was measured and their compositions were analyzed to obtain 85% lead and 15% sulfur trioxide; the chemical reation in the refining process was also examined. A filter, capable of collecting dusts up to the average size of 0.5 micron was installed. Problems such as cooling, plugging of pores, and noise were solved by cooling the exhaust to below the melting point of glass fibers; by adding no fresh air; and with exhaustive water treatment beforehand. The efficiency of the operation increased to 98%.

2566 APTIC NUMBER 20368

Hochgesand, Gerhard and Herbert Unland
PROCESS OF SEPARATING SOLVENT VAPOR AND WATER VAPOR FROM GASES IN SCRUBBING PROCESSES USING A LIQUID ORGANIC SOLVENT. (Metallgesellschaft A. G., Frankfurt (W. Germany)) U. S. Pat. 3,492,788. 4p., Feb. 3, 1970. 3 refs. (Appl. Feb. 28, 1969, 3 claims).

A process is presented for purifying industrial gases, in which the impurities contained in the gases are absorbed under pressure by a high-boiling organic solvent which is miscible with water and which is regenerated by being flashed and/or by being stripped with an inert gas, then subsequently returned to the

absorption tank. The water vapor is scrubbed by the absorbent from the gas streams which enter the process, the absorbent vapor is scrubbed by water from the gas streams which are discharged from the process, and the absorbent-water mixtures drained from these scrubbing states are jointly processed in a distillation unit using the exhaust gas from the flashing refrigeration unit as a stripping fluid. Regeneration of the solvent is carried out at ambient or slightly elevated temperature, under atmospheric or superatmospheric pressure, and without the need to flash to absorbent solution which has been laden under pressure. The exhaust gas from the flashing unit is heated and introduced into the bottom of the distillation column, which is provided with plates or packings to promote an exchange of material and divided into zones by lateral supply conduits. Water is supplied to the tops of the column so that the solvent vapor is scrubbed from the stripping gas in the uppermost zone. The next zone is supplied with the solvent-containing water that has been used to scrub the gas streams leaving the process. The lowermost zone is supplied with the water-containing solvent that has been used to scrub the gases entering the process. The removal of carbon dioxide, and the recovery of crude hydrogen, from a cracked gas produced by cracking liquid hydrocarbons with oxygen and steam is cited as an example of the process.

2567 APTIC NUMBER 20771

Hoenig, Stuart A.
SEPARATION COMPONENTS IN GASES. (Battelle Development Corp., Columbus, Ohio) U. S. Pat. 3,475,882. 4p., Nov. 4, 1969. 6 refs. (Appl. June 14, 1968, 5 claims).

The separation of gas components is accomplished with apparatus for selectively adsorbing donor and acceptor components at separate locations and then desorbing each into a separate chamber. Acceptor components of a gas are adsorbed on an n-type semiconductor surface, donor components on a p-type surface. Any excess gas is removed, and the conductivities of the surfaces are then modified, as by reversing them. Acceptor components of the gas are desorbed from the now p-type semiconductor surface to an adjacent chamber, and donor components are desorbed from the now n-type surface to a different adjacent chamber. Conductivities are controlled by an electric field gradient or by radiation. The normally p-type surfaces may comprise any suitable p-type semiconductor material such as copper oxide; or other semiconductor materials such as silicon, germanium, intermetallic compounds, organic materials, suitably doped with acceptor impurities to make the conductivity p-type; the normally n-type surfaces may comprise any suitable n-type material such as silicon, germanium, intermetallic compounds, or organic semiconductors, suitably doped with donor impurities to make the conductivity n-type. The apparatus can be used to separate water vapor from air, oxygen from nitrogen, carbon monoxide from air, and ammonia from nitrogen. Other applications are the separation of oxygen from carrier gases like argon in gas chromatography, and separation of nitrogen from carbon monoxide in mass spectrometry.

2568 APTIC NUMBER 20280

Hoff, Hans
APPARATUS FOR THE REMOVAL OF DUST FROM CONVERTER GASES. (Firma Gottfried Bischoff Bau Komp. Gasreinigungs- und Wasserruckkuhlanlagen Kommanditgesellschaft, Essen (West Germany)) U. S. Pat. 3,497,190. 6p., Feb. 24, 1970. 18 refs. (Appl. Sept. 19, 1967, 7 claims).

An improved apparatus for removing particulate matter from the waste gases of steel-making converters is described. A gas-collecting tube, where the oxygen/carbon monoxide reaction is carried out to completion, is situated above the converter. The tube opens into a dust-separating column and directs the gas against an impingement body. Water is sprayed into the gas between the impingement baffle and the wall of the column. The gas is then passed to a dust-collecting unit, such as an electrostatic precipitator or a filter. (Author abstract modified)

2569 APTIC NUMBER 20588

Hosfeld, W. F., R. S. Johnson, and W. H. Kolbe
THE GENERAL MOTORS CATALYTIC CONVERTER. Preprint, Society of Automotive Engineers, Inc., New York, 14p., 1962. 4 refs. (Presented at the Society of Automotive Engineers, Automobile Week, Detroit, Mich., March 12-16, 1962, Paper 486D.)

The General Motors Catalytic Converter system for reducing hydrocarbon and carbon monoxide emissions from automobiles is functionally and structurally satisfactory from a mechanical standpoint. An air pump, belt driven from the engine, takes in air through the carburetor air cleaner and discharges it into the exhaust pipe. The diluted exhaust gas then flows to the catalytic converter which replaces the conventional muffler. It is positioned as close to the engine as possible for maximum heat transfer to the catalyst during warm-up time and low, constant speed driving. At the entrance to the converter is a by-pass valve. It is used for over-temperature protection, and can direct the exhaust gas either under or through the bed. The catalyst bed is inclined with respect to the converter shell. This provides better gas velocity distribution throughout the bed. Two grid plates retain the catalyst and are supported so that they are free to expand in any lateral plane. Tests indicate that catalytic life is considerably less than the 12,000 miles required by the California Motor Vehicle Pollution Control Board. The level of exhaust emissions can be controlled by periodic catalyst replacement.

2570 APTIC NUMBER 21492

Hotti, G. and R. Tanner
HOW EUROPEAN ENGINEERS DESIGN INCINERATORS. Am. City, 1969: 107-112, 147, June 1969.

Current European design parameters for refuse incinerators are described. Heat utilization is considered in many plants. Neighborhood nuisances can be eliminated by proper design and

operation. Early systems of refuse destruction include cell furnaces, rotary kilns, and shaft furnaces. More recently, units with integrated combustion chambers proved to be superior. Maintaining a narrow temperature range, controlling the mix of the refuse, and matching the boiler size to the grate capacity all improve operating efficiency. Plant design is dependent upon firing efficiency, which is a function of all other determining factors. Due to the changing quality of refuse, redesign of incinerators is becoming necessary. Recent developmental trends are discussed.

2571 APTIC NUMBER 20501

Houdry, Eugene J. and Gordon P. Larson
AN ASPECT OF CATALYSIS IN MODERN LIFE. Preprint, American Chemical Society, Washington, D. C., 12p., 1962. 24 refs. (Presented at the American Chemical Society, 141st National Meeting, Washington, D. C., March 26, 1962.)

The use of the catalytic principle to eliminate automobile-exhaust contamination is proposed to reduce air pollution damage to vegetation, health and property, and as an immediate amelioration of the lung cancer problem. The present catalytic muffler is made of heat-resistant alloy steel and will efficiently oxidize hydrocarbons, carbon monoxide, tars, and smoke under normal driving conditions. A thin layer of insulation covers the muffler to protect car parts from excessive heat and also to prevent heat loss from the catalyst bed, while a valve located at the inlet of the muffler will divert the exhaust gas from the catalyst bed to the tailpipe in case of overheating.

2572 APTIC NUMBER 21297

Huehn, Walter
SOOT FORMATION AT COMBUSTION IN DIESEL ENGINES AND POSSIBILITIES OF REDUCTION. (Russbildung bei der dieselmotorischen Verbrennung und Moeglichkeiten ihrer Verminderung). Text in German. Motortech. Z. (Stuttgart), 31(3):109-114, 1970. (Presented at the 'Flensburger Hochschultage', March 13-15, 1969.)

The process of soot formation in diesel engine combustion consists essentially of two parts: dissociation of the fuel to acetylene and, very likely, also to butadiene; and formation of polycyclic carbon compounds with hydrogen association. Apart from oxygen, the presence of hydrogen plays an important role. With increasing oxygen concentration, the soot quantity decreases. With an increasing hydrogen fraction, the fraction of insoluble soot diminishes while the quantity of polycyclic aromatics remains constant until a mol ratio of hydrogen to ethylene becomes 0.4; then it increases. Soot formation can be counteracted by addition of water, nitrous oxide, and through fuel additives. Injection of a fuel-water emulsion begins to affect soot formation only when the water fraction is at 20% by weight. At a water content of 51% by weight, the soot content of the exhausts was reduced to half of the original quantity. Unfortunately, the fuel consumption increased by 16%. Addition of N2O has not only the advantage of reducing soot formation, but of also reducing the fuel consumption by 12% at constant power of the engine. Organometallic compounds consisting of one or more oil-soluble metal sulfonates or of an oil-soluble alkaline metal salt seem to be promising fuel additives for soot reduction. But many more studies are required to avoid, the disadvantage of depositions and higher wear and tear.

2573 APTIC NUMBER 21475

Humphreys, T. G., Jr.
LNG IN GAS DISTRIBUTION. Pipe Line Ind., 26(6):41-43, June 1967. (Presented at Southern Gas Association Annual Meeting, Dallas, Tex., April 10-12, 1967.)

Some of the benefits and problems associated with the operation of an LNG peak-shaving plant by a natural gas distribution company are documented. The advantages include flexibility of service and uninterrupted distribution under widely varying demand conditions. The problems were mostly mechanical in nature and were attributed to normal system debugging and acquisition of experience in the operation of a complex new system.

2574 APTIC NUMBER 21232

Hunter, J. B.
PLATINUM CATALYSTS FOR THE CONTROL OF AIR POLLUTION. A TAIL GAS REDUCTION SYSTEM FOR NITRIC ACID PLANTS. Platinum Metals Rev., vol. 9-12:2-6, 1965-1968. 1 ref.

Effective reduction of nitrogen oxides, hydrocarbons, and organic vapor is obtained by the use of platinum catalysts supported by a ceramic honeycomb. Use of the ceramic honeycomb support overcomes the two principle objections to platinum as a catalyst in pelletized form, pressure drops across pelleted beds, and loss of fines. Other important advantages for honeycomb catalysts are the elimination of hot spots, more uniform gas distribution, greater structural strength, and no channelling. From the standpoint of system design, the rigid structure also provides greater process flexibility. Horizontal as well as vertical reactors may be used. In nuclear power installations, intense radiation causes the decomposition of water into a hydrogen/oxygen mixture. Platinum honeycomb catalysts are effective as hydrogen/oxygen recombiners.

2575 APTIC NUMBER 20433

(Inventor not given.)
METHOD OF RECOVERY OF SULFUR DIOXIDE. (Procede de recuperation de l'anhydride sulfureux). Text in French. (Imperial Chemical Industries Ltd., London, England) French Pat. 755,255. 3p., Sept. 4, 1933. (Appl. May 6, 1933, 8 claims.)

Sulfur dioxide recovery methods where the gas containing SO2 in low concentrations, as for example, the gas resulting from roasting of S-bearing ore, is treated with a suitable solvent from which the

SO2 is, then, eliminated by heating and/or by lowering the pressure are presented. The regenerated solvent is reused to dissolve new amounts of SO2. These methods are characterized by the use of a solvent formed of an aqueous solution containing one or several salts of nonvolatile acids, the dissociation constants of which lie between 0.01 and 0.00001, as measured at a dilution of 40 liters per gram-molecule at a temperature of 25 C. The basic radicals of the salts are alkali metals, alkali earth metals, or ammonium. At least two salts are used simultaneously, derived from different acid and basic radicals. One or several of the salts are derived from weak organic acids, such as lactic acid, glycolic acid, or citric acid, the dissociation constants of which (measured under the above-mentioned conditions) have the following values: 0.00014, 0.00015 and 0.001, respectively. One or several of the salts are phosphates, the dissociation constant of orthophosphoric acid being 0.01. The aqueous solution contains a soluble phosphate and sodium citrate, salts of nonvolatile relatively weak acids, and salts of nonvolatile relatively strong acids. The concentration of sulfuric acid in the solution is controlled by replacing one part of it by a freshly made solution prior to reuse.

2576 APTIC NUMBER 20428

(Inventor not given.)
PROCEDURE FOR RECOVERY OF SULFUR DIOXIDE CONTAINED IN GAS MIXTURES. (Procede pour recuperer l'anhydride sulfureux contenu dans des melanges de gaz). Text in French. (Imperial Chemical Industrie Ltd., Billingham (England)) French Pat. 817,819. 3p., May 31, 1937. (Appl. Feb. 13, 1937, 8 claims.)

The invention concerns a procedure for recovering sulfur dioxide from gas mixtures by absorption, for subsequent extraction, in an absorbing liquor consisting of an aqueous medium and one or several organic bases. The liquor which has been used to absorb SO2 contained in the gas mixture is separated into a water layer and a layer containing the organic base in expelling the SO2 it contains. The water layer or a part of it is treated, in the presence of SO2 and of a neutral sulfate, by one, or several calcium compounds suitable for precipitating calcium sulfate. The aqueous medium forming a part of the absorbing liquor contains at least 50 g/l of the neutral sulfate. The water layer, or that part of it which is treated by one or several Ca compounds contains at least 100 g/l of dissolved SO2; a small fraction of the water layer is treated by one or several Ca compounds which are added in an amount of CaSO4 which is equivalent to the amount of H2SO4 contained in the entire liquor. The precipitate is removed and this fraction is returned to the main mass of the liquor. The absorbing liquor contains aniline, pyridine, quinoline, or crude xylidine as an organic base. The absorbing liquor contains Na2SO4, K2SO4, or (NH4)2SO4 as a neutral sulfate; the Ca compound is CaCO3. The H2SO4 concentration of the liquor in use does not exceed 0.25 g/l.

2577 APTIC NUMBER 20570

International Gas Union, Brussels (Belgium)
REPORT OF THE COMMITTEE ON NATURAL GASES AND MASS STORAGE. Intern. Gas Conf., 10th, Hamburg, Germany, 1967, 64p. 137 refs.

The activities of the Committee on Natural Gases and Mass Storage of the International Gas Union from 1964 to the present are reviewed. Much useful information is provided in the reports of the Subcommittees on Corrosion and Erosion, Gas Conditioning, Transport and Storage of Liquefied Natural Gas and Liquefied Petroleum Gas, and Storage in Geological Formations which constitute the major part of the report. Tables are included that indicate potential sources of natural gas for liquefied natural gas supply, natural gas production and reserves for selected countries, estimated liquefied petroleum gas consumption and production (1965-1970), peak shaving installations in the U. S., liquefied gas carriers in service, and refrigerated liquefied natural gas and liquefied petroleum gas storage facilities throughout the world. Evidence is presented indicating the technical feasibility of stimulating natural-gas reservoirs with the use of nuclear explosives and creating underground gas storage caverns with nuclear explosions in gas-confining structures or in sufficiently impermeable rock masses.

2578 APTIC NUMBER 21058

Ishikawa, Fumio
SMOKE AND DUST PROCESSING EQUIPMENT. (Baien Shori Sochi). Text in Japanese. (Assignee not given.) Japanese Pat. Sho 44-28069. 3p., Nov. 19, 1967. 1 ref. (Appl. March 5, 1964, claims not given.)

A method for separating soot from the smoke emitted by an incinerator is described. Above the smoke flue, from the side of the incinerator, a boiling water tank, water tank, and smoke exhaust fan are provided. When the smoke passes the flue under the boiling water tank, it is mixed and moistened by the steam of the boiling water which comes from small holes in the bottom plate of the tank. Secondly, passing the flue under the water tank, the soot in the smoke absorbs the water which drops from holes in the bottom of the tank. The smoke is blown through the chimney by the exhaust fan.

2579 APTIC NUMBER 21627

VDI (Verein Deutscher Zementwerke), Emissionsausschuss
RESTRICTION OF EMISSION PORTLAND-CEMENT WORKS. (Auswurfbegrenzung Zementwerke). VDI (Ver. Deut. Ingr.) Richtlinien, no. 2094, Feb. 1967. 15 refs. Translated from German by D. Ben Yaakov, Israel Program for Scientific Translations, Jerusalem, 26p.
CFSTI: TT 68-50469/12

The various sections of a cement plant yield dusts of widely differing composition, including raw-material dust, flue-gas dust from the kilns, clinker dust, coal dust, and cement dust; each of these requires a specific separation process. The production processes and equipment that emit dust in cement works as well as the technically most effective means of removal and the operating conditions that affect the dust content of the flue gases are described for kiln and drier systems, crushers, grinding and

drying mills, clinker coolers, and other equipment. Factors affecting collecting efficiency for centrifugal collectors, fabric filters, and electrostatic precipitators are outlined; aggregate-layer filters can also be used. A limit of 150 mg/cu m STP for particulate emissions is established for undisturbed and continuous operation of a new plant after a starting period. The emission of noxious gases is inherently very low in cement works and can be effectively dispersed from stacks.

2581 APTIC NUMBER 21457

Jackson, R. G.
TODAY'S PROCESSES FOR THE LIQUEFACTION OF NATURAL GAS. World Petrol, vol. 37, p. 52,54,56, Sept. 1966.

The current technology employed in purifying and liquefying natural gas is reviewed. Purification is an essential part of a liquefaction plant, since many compounds occurring in natural gas solidify at liquefaction temperatures and thus plug the equipment. Among the compounds are water, carbon dioxide, hydrogen sulfide, and heavier hydrocarbons. The regenerative absorbents used to treat the gas must be capable of reducing carbon dioxide to a concentration of 100 to 200 ppm and water and hydrogen sulfide to about 1 ppm. There is a trend toward using molecular sieves for the removal of both water and hydrogen sulfide. A popular liquefaction scheme is the cascade cycle, in which the heat is extracted from the natural gas in a series of steps corresponding as closely as possible to the cooling curve of the gas. The most efficient usage is found by taking propane, ethylene, and methane in three stages of refrigeration. Each state requires its own compressor to raise the pressure of the particular refrigerant to that required for its condensation against the previous refrigerant. A simpler type of liquefaction process involves the use of only one compressor and one refrigerant, a mixture of hydrocarbons and nitrogen which are obtained by extraction from the natural gas being liquefied. This process produces a series of cooling stages which are representative of mixtures cooled rather than a discontinuous series of steps as produced by the cascade cycle.

2581 APTIC NUMBER 21330

Jarzebski, Stefan
PHYSICAL/CHEMICAL PHENOMENA IN BRIQUETTE-FIRED CUPOLA FURNACES AND DUST REMOVAL FROM THE WASTE GASES. (Physikalisch-chemische Erscheinungen in mit Formkoks betriebenen Kupoloefen und Entwurfskonzept zur Entstaubung der Abgase). Text in German. Giesserei-technik, 16(3):91-97, March 1970. 73 refs. (Presented at the second meeting 'Combat Against Dust', Leipzig, Oct. 9 and 10, 1969.

Foundries in Poland are increasingly using briquettes instead of coke for firing their cupola furnaces. The briquettes contain about 0.5 to 0.7% sulfur, and are 30% lower in cost than coke. As a consequence of this new fuel, higher dust quantities are emitted. Cyclones, wet collectors, scrubbers, silikonized glass fiber filters and sedimentation chambers can be used for removing the high dust concentrations from these waste gases. Electrostatic precipitators are not frequently used for this purpose. Tests with a packed tower using granulated slag yielded satisfactory results. This method has the advantage that the gases can be cleaned at temperatures of 670 K and higher and that it is particularly efficient for fine dust. However, the spent slag must be frequently replaced and the facility has large dimensions. A two-stage cleaning system comprising a cyclone and a slag-packed tower would avoid these disadvantages. At a minimum efficiency of the first stage of 60% and 80% of the second stage, waste gases with a dust content of 10 g/cu m could theoretically be cleaned to a residual dust quantity of 0.8 g/cu m. First test results with this cleaning system brought good results and confirmed the theoretical collection efficiency.

2582 APTIC NUMBER 20510

Jean Pierre, Rene, Jean Solinhac, Georges Molinet, and Rene Terminet
METHOD OF RECOVERY OF GASEOUS SULFUR COMPOUNDS CONTAINED IN WEAK CONCENTRATIONS IN RESIDUAL AND FLUE GASES. (Procede de recuperation de composes sulfures gazeux contenus en faibles concentrations dans les gaz residuaires et fumees). Text in French. (Societe nationale des petroles d'Aquitaine, Paris (France)), French Pat. 1,353,606. 2p., Jan. 20, 1964. (Appl. Jan. 17, 1963, 2 claims).

A process is presented of treating gases containing between 0 and 5 volume % of gaseous sulfur compounds which involves two stages: an adsorption stage in which the gas is passed over an adsorbent medium consisting largely of granular alumina at a temperature between ambient and about 150 C, and a desorption-regeneration stage in which the adsorbed S compounds are desorbed and the adsorbent medium is simultaneously regenerated by heating, combustion, or removal by hot inert gases, or superheated steam at a temperature above or equal to about 150 C. Either stage can be carried out using a fixed moving, or fluidized bed and the uniflow or the counterflow mode of operation. The amount of alumina used in the process is such that the ratio of the weights of the adsorbed product(s) and the adsorbent does not exceed the limit set to obtain the desired yield. Its grain size depends primarily of the pressure drop admissible in the equipment used, while the physical and chemical characteristics of the adsorbent are determined by the nature of the S compounds to be adsorbed and/or of the regeneration products and by the desired yield. Three specific numerical examples of the required computations are given: when the gas to be treated contains hydrogen sulfide only, SO2 only, or H2S and SO2 simultaneously. The process may be used to obtain the gaseous S compounds at considerably higher concentrations than they had in the gases prior to their treatment and is an effective and economical tool for combating air pollution by cement plants, sulfur plants using the Claus process, oil refineries, coking plants, etc.

2583 APTIC NUMBER 21506

Johnstone, H. F.
METALLIC IONS AS CATALYSTS FOR THE REMOVAL OF SULFUR DIOXIDE FROM BOILER FURNACE GASES. Ind. Eng. Chem., vol. 23:559-561, May 1931.

7 refs. (Presented at the American Chemical Society Meeting, Division of Industrial and Engineering Chemistry 81st., Indianapolis, Ind., March 30-April 1, 1931.)

A method to remove sulfur dioxide from stack gases is described. The method involves increasing the solubility of SO2 in water, or aqueous solution, to such an extent that the amount of water required for the removal of SO2 from gases containing very small concentrations of this constituent would be reduced to a point where the process would be economically and mechanically feasible. The capacity of water for absorbing SO2 may be increased by introducing a catalyst to hasten the reaction between the dissolved gas and oxygen. An experimental procedure using metals and metal sulfates as catalysts is described, and test results are given.

2584 APTIC NUMBER 20366

Juenq, Carl P.
METHOD AND APPARATUS FOR EXHAUSTING GASES FROM INDUSTRIAL BUILDINGS. (Robertson (H. H.) Co., Pittsburgh, Pa.) U. S. Pat. 3,492,789. 4p., Feb. 3, 1970. 2 refs. (Appl. May 16, 1968, 10 claims).

A ventilation procedure for factories producing aluminum or similar compounds is described that produces a single exhaust stream of relatively low velocity exhaust gases, thereby permitting all of the surface area of filter mats in the wet scrubbing zone to be utilized. The invention also concerns the placement of exhaust fans to prevent their corrosion by hydrofluoric acid escaping from the wet scrubber. The exhaust gas is divided into two separate streams, each stream separately pressurized by fans and impinging against one another in a mixing zone prior to emergence into the wet scrubbing zone as a single stream. Since the fans are placed at fixed intervals along the length of the mixing zone, which extends continuously above the heat-generating apparatus, the pressurized streams expand horizontally and vertically. This reduces their velocity to a low value prior to introduction into the wet scrubbing zone. Contact between the fans and any corrosive fluids escaping from the wet scrubbing zone is avoided by positioning the fans upstream of the scrubbing zone. Apparatus for carrying out the method is provided.

2585 APTIC NUMBER 21059

Kaigisho, Tokyo Shoko
PUBLICE NUISANCE - PRESENT STATUS AND COUNTERMEASURES IN THE INDUSTRIAL AREAS OF JOTO AND JOHAN. (Kogai - Joto Johan chiku kojo chitai no genjo to taisaku). Text in Japanese. Tokyo Chamber of Commerce and Industry, 101p., March 30, 1970.

This report is based on the reply to a questionnaire sent out to 1271 factories between Aug. 1 and Sept. 15, 1969. Half of the factories had received complaints on public nuisance, among which noise was predominant, followed by dust and smoke, vibration, offensive odor, exhaust gas, and contaminated water. Of the total consumption of crude oil, 17% was the low-sulfur type. Industrial waste disposal was a problem for 16.8% of the factories, while another three-quarters of the factories solved the problem by direct negotiation with the suffered party and subsequent emergency countermeasures. Several factories spent more than 10% of the total sales for the countermeasures; more than half paid the expenses out of their own capital, and almost as many more made up the cost by an increase in production and sale. Most of the companies realized the seriousness of the public nuisance, but medium and small-scale ones could not take necessary countermeasures because of financial problems. Each case of the public nuisance is listed together with countermeasures taken.

2586 APTIC NUMBER 20673

Kalika, Peter W.
GAS CLEANING SCRUBBER. (Combustion Engineering, Inc., Windsor Conn.) U. S. Pat. 3,490,204. 4p., Jan 20, 1970. 17 refs. (Appl. Dec. 26, 1967, 3 claims).

A method is decribed by which hot dirty gases are scrubbed at high velocity with less pressure drop than in a conventional scrubber but with a higher collection efficiency than conventional Venturi scrubbers. Dirty gases are accelerated in an improved Venturi section to a Mach number of about 0.6, and the gases are evaporatively cooled by introducing water spray. They are decelerated, and a second water spray is introduced downstream where the gases are flowing at a lower velocity which is comparable to that of a conventional Venturi scrubber. Downstream of the second spray, the agglomerated particles of water and dust are separated from the gas by a conventional separator and removed from the gas stream. Generally fresh water is supplied to the upstream spray and recirculated water from the separator may be supplied to the downstream spray. Then the gas flow rate is substantially less then the maximum design capacity, the Venturi section may be reduced in flow area to maintain the substantial aerothermopressor pressure increase, or used as a conventional Venturi scrubber at the new lower velocity occuring in the Venturi throat. Bypass around the high velocity section includes a steam ejector and is used to avoid stalling the aerothermopressor system in the event of a gas flow overload. (Author abstract modified)

2587 APTIC NUMBER 20697

Kato, Takeshi, Shigeru Maehara, Shigeaki Morita, Minoru Nishiwaki, Isoji Igarashi, Koichi Tagiri, and Susumu Narita
PROCESS FOR DISCHARGING UNBURNED WASTE GAS FROM OXYGEN TOP-BLOWING CONVERTER. (Yawata Iron and Steel Co., Ltd., Tokyo (Japan) and Yokoyama Engineering Co., Ltd., Tokyo (Japan)) U. S. Pat. 3,494,763. 4p., Feb. 10, 1970. 6 refs. (Appl. Jan. 12, 1967, 1 claim).

A process is presented for discharging and recovering unburned waste gas from an oxygen top-blowing converter. The gas recovery

system has a vertically movable hood which is mounted on the converter in such a way that when it is lowered, only a small gap is left between the hood and the converter mouth. Oxygen blowing is started while the hood is raised; but after ignition, the hood is lowered and the pressure in the recovery system controlled to from -1 to -10 mm. By so regulating the waste gas flow in the system and inducing a small amount of air through the unavoidable small gap, leakage of waste gas through the gap is prevented.

2588 APTIC NUMBER 20333

Kato, Yujiro
PLANS AND OPERATIONAL EXAMPLES ON FILTER-TYPE DUST COLLECTOR SYSTEM AT VARIOUS INDUSTRIES (I). (Gyoshubetsu ni miru rokashiki shujinsochi no keikaku to unten jisshirei (I)). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(2):91-95, Feb. 15, 1968.

Air is naturally contaminated by foreign matter. Pollution becomes a particularly serious problem, however, when man-made pollutants are dispersed into the air in large amounts. A high concentration of pollutants is sometimes harmful to human health and can even cause death. Therefore, an ideal remedy for air pollution is to make the contaminated air cleaner than the air under ordinary conditions. It is also desirable to make contaminated air invisible. A filter is most efficient for this purpose. The filters used in air pollution control are usually bag filters. A bag filter can remove all kinds of airborne dust from the gas passing through it. Since the first bag filter was patented in Germany in 1868, development has been in such important factors as dust, gas, materials, manner of weaving, methods of treatment, and cleaning mechanisms. Today the bag filter is a necessary equipment for a carbon black plant, a plastics plant, or metal-refineries. With today's technique, it became possible to operate it under conditions which would have been unthinkable a decade ago. The quantitative characteristics of filter bags and the various types of bag filters are indicated. The components of a filter system composed of cylindric filter bags which are cleaned shaking are discussed and illustrated. It is noted that the airborne dust is not collected on the filter fabric but on the dust film. In other words, it is dust itself which collects the airborne dust and the filter fabric is only a support for the dust film.

2589 APTIC NUMBER 20334

Kato, Yujiro
PLANS AND OPERATIONAL EXAMPLES ON FILTER TYPE DUST COLLECTOR SYSTEM AT VARIOUS INDUSTRIES (II). THE ROLE OF BAG FILTER IN THE CHEMICAL INDUSTRY (I). (Gyoshubetsu ni miru rokashiki shujin sochi no keikaku to unten jisshi rei (II). Kagakukogyo ni okeru baggu firuta (sono I). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(3):153-157, March 15, 1968.

The carbon black industry is representative of industries where bag filters are indispersible; carbon black operations are described in detail. Carbon black particles are quite small and their blackness often causes environmental pollution problems. Therefore, the value of bag filters with high efficiencies is recognized by the industry. The method of carbon black production is to burn oil incompletely and collect soot. Among collectors, a dried-type bag filter is the only one which agrees with the gas conditions. However there remains the problem of large amounts of water contained in the gas. The gas, which passes through a cooling tower after leaving the furnace, contains 45% water. Because the temperatures of gas above dew point, or at about 250 C, must be kept, the filter fabric must be fiberglass. A carbon-black plant requires a N. bag filter, a P.C. bag filter, and a S. bag filter. The first collects the dust which passes a cyclone collector and the second collects the dust conveyed by a pneumatic conveyer from the cyclone collector. The third filter is used for operational environmental pollution control. Points of operation and operational conditions for each bag filter are reviewed, as well as characteristics of fiberglass filters. The findings reported can be extrapolated to the filtration of gases of high temperatures and high humidity in other industries.

2590 APTIC NUMBER 21186

Kato, Yujiro
PLANS AND OPERATIONAL EXAMPLES ON FILTER TYPE DUST COLLECTOR SYSTEM AT VARIOUS INDUSTRIES (III). THE ROLE OF BAG FILTERS IN THE CHEMICAL INDUSTRY (II). (Gyoshubetsu ni miru rokashiki shujinsochi no keikaku to unten jisshirei (III) - Kagakukogyo ni okeru baggu firuta (sono II). Text in Japanese. Kogai to Taisaku (J. Pollution control), 4(4):227-233, April 15, 1968.

The applications of bag filters for controlling dust emissions in the chemical industry are reviewed. In the chemical fertilizer industry, the production of dust and fumes in the raw material stage, manufacturing process, conveying process and packing process are unavoidable. Specifically cited are the baghouses employed for controlling emissions from the phosphate-ore cyclic milling and cooling and the soda-ash manufacturing process. In the agricultural-medicine manufacturing industry, high-efficiency collectors are mandatory since the dust is extremely toxic and cannot be allowed to escape into the atmosphere, even in small amounts. For this reason, baghouses are the most common control devices in the industry. In the carbide manufacturing industry, the baghouse is employed for controlling emissions from the coke driers. The baghouse is also indispensible in the polylefin manufacuring industry, particularly for collecting dust from the driers and from rubber compounding processes. In its raw state rubber is too plastic for most commercial applications. By compounding the raw rubber with various types and amounts of additives, the desirable properties can be imparted to the rubber. Among the additives carbon black is the most troublesome. All the examples presented are cases where adequate filtration was once regarded as impossible but where it has been achieved.

2591 APTIC NUMBER 21187

Kato, Yujiro
PLANS AND OPERATIONAL EXAMPLES ON FILTER TYPE DUST COLLECTOR SYSTEM AT VARIOUS INDUSTRIES (IV). THE ROLE OF BAG FILTERS IN THE CERAMIC

INDUSTRY (I). (Gyoshubetsu ni suru rokashiki shujinsochi no keikaku to untenjisshirey (IV) - yogyo ni okeru baggu-firuta (sono I). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(6):385-389, June 15, 1968.

A baghouse is the most suitable type of dust collector for the cement industry. The raw-material mixer, the kiln exhaust, the clinker cooler, the clinker storage, the finishing mill, the packer, the tanker, and the cement-receiving station are the possible emission points in a cement plant. The operational conditions of bag filters installed at these points are reviewed. Dust from a dry-type kiln results from the finely powdered material. In the American plant described, the bag filters are located at the top of the silo to control dust created in conveying and mixing processes. Since multi-cyclones have low collection efficiencies, baghouses are being increasingly used to control the large volumes of dust emitted by the clinker cooler. The cement product which comes from the finishing mill is swept through the separator, cyclone, and the baghouse; in this process, the baghouse plays the most important role. With reference to the baghouse for the packer, the hood method is considered. Also noted is the ability of the baghouse to deal with an airstream the inlet concentration of which is several kgm per cu m, despite predicitons to the contrary.

2592 APTIC NUMBER 21324

Kato, Yujiro
PLANS AND OPERATIONAL EXAMPLES ON FILTER TYPE DUST COLLECTOR SYSTEM AT VARIOUS INDUSTRIES (VI). THE ROLE OF BAG FILTERS IN THE METALWORKING INDUSTRY. (Gyoshubetsu ni miru rokashiki shujin sochi no keikaku to unten jisshi rei (VI). Kinzoku kogyo ni okeru baggu firuta). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(10):663-668, Oct. 15, 1968.

The operational conditions of bag filters used for emission control in the metalworking industry are illustrated by examples. In the zinc refining industry, bag filters are used at various points. The baghouse for the independent electric power plant which is provided to allow the exhausted material to cool down is one example. Another is the baghouse for controlling emissions from a smelting furnace exhaust. The applications of bag filters to the aluminum industry is illustrated by the baghouse used to control emissions from an alumina coveying process. In a powdered lead manufacturing plant, a complete dust collector has to be provided since the lead dust is extremely toxic and cannot be allowed to escape into the atmosphere. Complete hooding is also necessary. In the nonferrous metal working industry, emissions are commonly worth recovering. High efficient dust collectors are adequate for this purpose. In the iron and steel industry, the collected material from the exhaust is generally of little value, but dust collectors are necessary for air pollution control. Their use is typified by baghouses equipped for controlling emissions from electric-arc steelmaking furnaces and from electric furnaces for ferro-alloy manufacture. In the metal processing industry, bag filters are also used for controlling emissions from various processes. An example is the baghouse equipped for controlling emissions from the finishing process of iron casting.

2593 APTIC NUMBER 21407

Kato, Yujiro
PLANS AND OPERATIONAL EXAMPLES ON FILTER TYPE DUST COLLECTOR SYSTEM AT VARIOUS INDUSTRIES (VII). THE ROLE OF BAG FILTERS IN VARIOUS INDUSTRIES. (Gyoshubetsu ni miru rokashiki shujin sochi no keikaku to unten jisshirei (VII). Kakushu kogyo ni okeru baggu firuta). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(12):804-808, Dec. 15, 1968.

Factors contributing to the efficiency of bag filters are summarized and additional instances of their industrial applications are presented. An example of a baghouse employed by the food industry controls emissions from pneumatic conveyors for cornstarch. The operation of a typical unit is described. Bag filters are also utilzied to reduce the aerosols produced by fermentation processes. In the paper industry, there are a few processes in which powdered materials are handled, e.g., casting terra alba and talc in a dissolving bath. A baghouse for controlling emissions from such a process is described. In the medical supplies industry and in the cosmetics industry, bag filters are used for various processes. Cited as an example is the baghouse equipped for collecting emissions from the last stage of cosmetics production. Other industries mentioned are cable and the coke manufacturing. A baghouse equipped for controlling emissions from the steam-heating exhaust is also noted. In conclusion, the function of bag filters depends on three factors: filtering efficiency, the lifetime of the filter fabric, and filter resistance. Filters function most effectively when these three factors are harmonized and when appropriate cleaning methods are employed.

2594 APTIC NUMBER 20914

Katz, S. and R. D. Oldenkamp
INTEGRATION OF MOLTEN CARBONATE PROCESS FOR CONTROL OF SULFUR OXIDE EMISSIONS INTO A POWER PLANT. Preprint, American Society of Mechanical Engineers, New York, 7p., 1969. 5 refs. (Presented at the American Society of Mechanical Engineers, Winter Annual Meeting, Los Angeles, Calif., Nov. 16-20, 1969, Paper 69-WA/APC-6.)

The molten carbonate process (MCP) is being developed to remove sulfur oxides from power plant stack gases. The process is a closed cycle system in which a molten eutectic mixture of sodium, lithium, and potassium carbonate is circulated to convert the sulfur oxides to sulfites and sulfates, which remain dissolved in excess carbonate. Conversions of 90% can be achieved without raising the melting point of the mixtures above 800 F. The salt mixture containing the sulfites and sulfates is subsequently reduced chemically to the sulfide form, then regenerated to the original carbonate form. The regeneration step releases hydrogen sulfide which can be converted to elemental sulfur or sulfuric acid. The process equipment is divided into two parts: equipment located outside the power plant stream, and equipment located in the flue gas stream. Optimum process component configuration for an 800 Mwe plant is discussed. Preliminary analyses indicate that

a plant using carbon for the reduction step would cost $9.0 million. Annual operating costs would be 0.44 mils/kw-hr before the sale of the sulfur produced.

2595 APTIC NUMBER 21222

Kaufman, J. G., Holt, M., and E. T. Wanderer
ALUMINUM FILLS CRYOGENIC NEEDS. Oil Gas J., 65(50):118-123,126, Dec. 11, 1967. 14 refs.

Diversity of form, ease of fabrication and welding, high corrosion resistance, and excellent mechanical properties under cryogenic conditions are given as reasons for the selection of aluminum for economic and efficient structures and processes. Several methods of classifying aluminum alloys, including strengthening mechanism, weldability, and principle alloying element, are described. Typical tensile properties of selected alloys at several temperatures are presented. The terms fracture characteristics, tear resistance, fracture toughness, and joining are defined and analyzed. Comments are made regarding characteristics of the various series of commercial aluminum alloys. Some of the applications of aluminum in the areas of process, storage, and transportation are listed. Probably the largest cryogenic tanks of aluminum are in the liquefied natural gas industry. Marine transport of LNG at about -259 F utilizes the alloys, as exemplified by the ship METHANE PIONEER which was fitted with 5 tanks having a total capacity of 35,000 bbl.

2596 APTIC NUMBER 20748

Kearby, Kenneth K. and Robert J. Lang
CATALYTIC PURIFICATION TREATMENT OF EXHAUST GAS. (Esso Research and Engineering Co., Linden, N. J.) U. S. Pat. 3,476,508. 4p., Nov. 4, 1969. 7 refs. (Appl. Oct. 27, 1965, 5 claims).

A catalytic treatment of exhaust gases from internal combustion engines decomposes unburned hydrocarbons. The gases are contacted with a zeolite catalyst at a temperature of 500 to 1500 F. The hydrocarbons are eliminated without added oxygen. The treated gases are then contacted with a shift catalyst containing a hydrogenating metal, preferably iron, which promotes the reduction of nitric oxide and the conversion of carbon monoxide to carbon dioxide. The zeolite catalyst is a faudasite zeolite that contains 5% to 12% zinc by ion exchange. Both catalysts are resistant to poisoning by substances containing sulfur, lead, halogens, and phosphorus.

2597 APTIC NUMBER 21163

Kelly, C. I.
LIQUID METHANE BEHIND THE IRON CURTAIN. PART I. Petrol. Times, 1960:817-821, Dec. 2, 1960. 16 refs. PART II. Ibid, 1961: 97-98, Jan. 27, 1961.

Design and operation information for a natural gas liquefaction/storage/regasification (LSR) plant completed in Moscow, U.S.S.R. in 1954 are presented in Part 1. Distribution and use data for gas processed at that plant are presented in Part 2. The plant was designed and partially fabricated in the United States. When termination of the Lend-Lease Program in 1948 prevented the export of the final components to Russia, the design and fabrication were completed in Russia. A comparison of the U. S. and Russian designs is made. Two unique items are the methane road tankers fueled by boil-off gas from their own storage tanks and methane fueled trucks for local delivery service. In addition to significantly reducing exhaust emissions, it is claimed that methane as an automotive fuel is competitive economically with other fuels. A price comparison table is presented in Part 2.

2598 APTIC NUMBER 21609

Kelly, C. I.
STATIC STORAGE OF LIQUID METHANE. Petrol. Times, 65(1663):303-306, May 5, 1961. Part II. Ibid, 65(1666):493-496, July 28, 1961.

Based on patent specifications, the physical construction of three shore storage tanks used to facilitate seven trial shipments of liquid meth are reviewed. One tank was built to hold 35,000 barrels; the others, 15,000 barrels each. Each tank is a cylindrical, double-walled vessel with aluminum-magnesium alloy inner shells. Special attention is given to the arrangement of the insulation spaces. The larger tank uses a resilient blanket of bonded acetate fibers to cover the outside wall and the roof of the inner vessel. The remainder of the space between the side walls and the roofs of the inner and outer vessel are filled with expanded perlitel. During warming up, the inner vessel's diameter increases and the total thickness of the annular space diminishes commensurately, but the blanket is compressed so that the lateral pressure of the insulating material never becomes great enough to cause significant crushing or compaction. In the second vessel, the annular space between the circular walls of the inner and outer tanks is surrounded by an eight-layer mat of fibrous cellulose. Powdered perlite fills the remainder of the insulating space and also extends over the top of the inner shell. When the inner shell expands, the movement is partly taken up by compressing the mat. The inward pressure exerted on the inner shell is very small compared with that exerted by the perlite in the absence of the mat. The third design puts an intermediate wall of corrugated aluminum sheets into the insulating space. When the inner shell contracts, each of the sheets contracts separately in a longitudinal direction. The diameter of the intermediate wall does not alter and the perlite filling is not disturbed, so there is no tendency for pressure to build up in the insulation. In closing, cost data is presented to show that the storage of liquid methane in pre-stressed concrete metal liners, caverns, and stainless steel containers should be substantially less than that for storage in aluminum-magnesium alloy tanks.

2599 APTIC NUMBER 21236

Kelly, C. I.
SUB-SURFACE STORAGE SYSTEMS FOR LIQUID METHANE. Petrol. Times,

vol. 65:771-778, Dec. 1, 1961.

The ground storage system for liquid methane differs radically from surface cavities for non-volatile liquid petroleum products. The earthen cavity for ground storage is rendered fluid-tight by freezing the wet soil making up the walls and bottom. The domed roof is internally insulated aluminum, sealed to the earth by an undisclosed method. Another proposed underground storage facility is located below the water table in a permeable water-bearing formation. Again, the surrounding earth is frozen to prevent leakage. Above ground possibilities also exist. A surface-earthen reservoir (sealed) system, utilizing drained ponds, quarries, and pits can be constructed in almost any locality. Prestressed concrete is an entirely acceptable structural material for cryogenic storage.

2600 APTIC NUMBER 20752

Keough, William R.
APPARATUS FOR TREATING EXHAUST GASES FROM A STACK. (Assignee not given.) U. S. Pat. 3,478,496. 3p., Nov. 18, 1969. 8 refs. (Appl. Nov. 13, 1967, 2 claims).

A simple and inexpensive means is provided for eliminating impurities from exhaust gases. This is accomplished by producing a water jacket around the open end of a conventional stack and forcing the exhaust gases through the jacket to remove the impurities. A cap-like enclosure having a substantially planar upper wall and an inclined lower wall is placed over the stack. The lower wall has a trough for collecting water and a skirt portion which is held in spaced relation with respect to the outer surface of the stack to provide a space between the side wall of the stack and the skirt. A rotating fan located in the enclosure above the end of stack diverts upward flowing gas outwardly into the chamber. A water inlet in the housing is attached to the fan for producing the water jacket or curtain which flows downwardly into the trough. All solids and water soluble materials are collected in the trough. The flow of exhaust gases outwardly into the chamber produces a positive pressure in the space, thus causing the gases to be forced through the curtain a second time and eventually directed into the open space defined by the skirt portion and the outer wall of the stack. This results in a further filtering of the exhaust gases.

2601 APTIC NUMBER 20477

Mercher, Hermann
ELECTRIC WIND, BACK DISCHARGE AND DUST RESISTANCE AS PARAMETERS IN ELECTROSTATIC PRECIPITATORS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(8):18-20, Aug. 1969. 8 refs.

The effects of electric wind, back discharge, and dust resistivity on gas scrubbing in electrostatic precipitators were determined in pilot plant studies. Point-plate devices with revolving collecting plates were used in both electric wind and back discharge tests. In the range of high current densitities, the transverse velocity components of electric wind are high, with the wind constituting a turbulence directed toward the collecting plate. This turbulence, in conjunction with rapid particle discharge, effects an enrichment of the entrained dust particles in the gas near the precipitator wall. Back discharge completely alters the current flow conditions through the dust layer, but there is no drop in efficiency if the filter is operated from the start at a low voltage and then brought to the point of back discharge by corresponding dust conditioning. It is important to maintain a constant voltage, despite rising current consumption. Dust resistivity was determined in a flue duct at an electrically sprayed dust layer. In the case of highly resistive dusts, the determinations were influenced predominately by temperature and humidity. Bulk density was the decisive factor for low-resistivity dusts. For dust which is difficult to separate, the resistivity is the decisive parameter for electrostatic precipitators. Nevertheless, correct measurements and suitable conditioning will enable efficient precipitator operation.

2602 APTIC NUMBER 20765

Keuls, Henry P. C.
AIR PURIFIER AND HUMIDIFIER. (Assignee not given.) U. S. Pat. 3,474,598. 9p., Oct. 28, 1969. 21 refs. (Appl. Feb. 27, 1968, 8 claims).

In most air temperature control systems employing forced air flow, substantial amounts of dust and dirt accumulate in the ducts, coils, and other equipment with time, producing an unpleasant odor which is carried into individual rooms by the flowing air. A device which effectively purifies and humidifies the air is provided to be used in conjunction with a standard air temperature control system exhaust unit. It includes a housing whose side walls contain glide channels extending along the length of the housing while the top wall has at least one elongated air outlet across which a removable filter is mounted. A water reservoir, removably mounted within the purifier, contains a wick that absorbs water from the reservoir and provides an increased and roughened surface area across which the incoming air flows. Baffles or air guides direct the incoming air toward the reservoir and wick. A great majority of the dust particles in the incoming air adhere to the wick or fall into the reservoir; those particles not removed by the wick or reservoir are moved by the filter through which the air flows as it leaves the purifier. The length of the purifier can be adjusted to correspond to the length of the existing air temperature control system exhaust unit. The reservoir is easily removed for refilling and the filter and wick removed easily for cleaning.

2603 APTIC NUMBER 21602

Kindig, James K.
ELIMINATION OF AIR POLLUTION FROM BURNING REFUSE PILES. Pennsylvania State Univ., University Park, Research Grant AP-00065-02, Prog. Rept. 2, 75p., 1963. (Presented to the Am. Mining Congr., Coal Preparation Committee, Morgantown, W. Va., Sept., 1963; and Soc. of Mining Engrs., New York, N. Y. Feb. 1964.)

For the separation of coal refuse into a nonburning fraction and a low grade fuel of significant caloric value, four unique plant or material processing flowsheets were conceived. These flowsheets were evaluated on the basis of their technical and economical capability for processing high specific gravity coal refuse into an acceptable clean secondary refuse and a low grade fuel. A heavy media centrifugal-type cleaner was selected. Concurrent with plant design, potential locations for the experimental refuse processing plant were studied and evaluated. Lanchashire Mine No. 15 of the Barnes and Tucker Coal Co., Barnsboro, Pa., satisfactorily met the criteria, and work has begun on the design and fabrication of the requisite auxiliary system. Complete washability tests were conducted to provide additional plant design data for this location and another potential site. The ignition furnace tests designed to simulate conditions in the refuse pile have continued. The furnace is heated linearly until a specific temperature is reached, and this temperature is held constant until the sample can react through spontaneous combustion. If the oxidation proceeds, its heating curve will penetrate the constant temperature curve, thereby establishing the heating nature of that sample. Results of the samples tested have been most satisfactory. (Author abstract modified)

2604 APTIC NUMBER 21008

King, James Frank, Jr.
AUTOMATIC CLEANING FILTERING APPARATUS. (Bahnson Co., Winston-Salem, N. C.) U. S. Pat. 3,483,675. 15p., Dec. 16, 1969. 12 refs. (Appl. Jan 12, 1967, 10 claims).

A rotary cylindrical drum type filter is described for extracting contaminants from an air stream containing lint laden air. The lint laden air enters an open end of the filter drum along air flow paths substantially paralleling the axis of rotation of the drum and is withdrawn through the drum wall along withdrawal air flow paths transverse to the axis of rotation to accumulate the contaminants on the interior surface of the drum wall. Apparatus is provided to produce suction withdrawal of the contaminants from a selected location within the drum, and for periodically blowing high pressure air inwardly through the drum wall during rotation of the drum to dislodge the contaminant accumulations from the wall and blow them back along paths counter to the withdrawal air flow paths and to the suction location. (Author abstract)

2605 APTIC NUMBER 20327

King, James F. Jr. and Donald Alfred Sloan
CLEANING APPARATUS FOR ROTARY DRUM FILTERS. (Bahnson Co., Winston-Salem, N. C.) U. S. Pat. 3,499,267. 9p., March 10, 1970. 7 refs. (Appl. Aug. 20, 1968, 9 claims).

Apparatus for cleaning the filter medium surface of a rotary drum type filter is described, wherein contaminant laden air enters an open end of the filter drum and is withdrawn outwardly through the filter medium wall to accumulate the contaminants on the interior surface of the drum wall. Suction collection withdraws the contaminants from a selected location within the drum. A blower nozzle outwardly adjacent to the drum wall is reciprocated along a scanning path paralleling the drum axis during rotation of the drum to dislodge the contaminant accumulations from the drum wall and cause them to migrate to the suction location. The blower nozzle may be rotated in a special manner to keep the mat of accumulated contaminants from rotating or curling back on itself and to cause the mat to be exploded away from the filter medium surface. (Author abstract modified)

2606 APTIC NUMBER 21428

Kinne, Hubert Josef
METHOD OF FIXING IONIZATION WIRES TO A MOUNTING FRAME IN AN ELECTROSTATIC PRECIPITATOR. (Einrichtung zur mittelbaren Befestigung eines das elektrische Spannungsfeld erzeugenden Sprueh drahtes an einem Traghalm in eines elektrostatischen Staubabscheider). Text in German. (Kloeckner-Humboldt A. G., Cologne (West Germany)) Swiss Pat. 470,206. 3p., March 31, 1969. (Appl. June 11, 1968, 1 claim).

The ionization wires are rigidly connected in an electrostatic precipitator on their upper ends with a sheet steel sleeve by pinching or welding. The sleeves sit in a mounting rod. Instead of the full circular sleeves, semi-circular sleeves can be used. This method of fastening ionization wires has the advantage that differently thick wires receive the same sleeve. Furthermore, sleeve and wire can be connected outside the precipitator and then simply inserted into the mounting rod. Replacement of damaged ionization wires is greatly simplified.

2607 APTIC NUMBER 20340

Kinney, William L.
AIR FILTER ASSEMBLY AND SUB-ASSEMBLIES. (Microtron Corp., Charlotte, N. C.) U. S. Pat. 3,494,113. 7p., Feb. 10, 1970. 17 refs. (Appl. May 22, 1968, 3 claims).

An air filter assembly for use in air cooling and heating systems is described which provides for easy removal and dismantling of the interior components for replacement purposes. It compromises a hollow, open-ended housing having a generally rectangular cross-section, which is secured in an air flow passageway of the cooling and heating system, and with open ends which are connected to respective portions of the air flow passageways so that the housing will form part of it. The housing includes sealing means on the inside surface and means for providing access to the interior. A removable, open-ended hollow cartridge is positioned within the housing to allow the passage of air. It is preferably formed of rigid, compressible, closed-cell foam material which provides a light-weight, low cost structure, and which, through the compressibility characteristic, allows a forced friction fit with the housing for sealing purposes. A porous filter media is positioned within the cartridge in a pleated arrangement forming a plurality of downstream extending pockets in the air flow stream. Its opposite edges are positioned within the cartridge sealing

grooves and extend across the entire interior opening in the cartridge in sealing engagement to force the flow of air through the media. Air-filter media preferably comprises two superimposed continuous layers of resin-bonded, non-woven material, a plurality of rigid, generally rectangular, separate, frame members positioned between the superimposed layers of non-woven material in a spaced, side-by-side relationship for aiding in the support of the filter media in the pleated, pocketed configuration.

2608 APTIC NUMBER 21199

Kirk, Merritt C., Jr.
PROCESS FOR HYDRODESULFURIZATION OF CRACKED GAS OILS AND THE PRODUCTION OF DIMETHYLDECALINS AND FUEL OIL BLENDING COMPONENTS. (Sun Oil Co., Philadelphia, Pa.) U. S. Pat. 3,481,996. 7p., Dec. 2, 1969. 3 refs. (Appl. Dec. 4, 1968, 12 claims).

Dimethyldecalins and fuel oil blending components having an improved cetane number. A decreased tendency to produce smoke on burning can be produced from cracked gas oil by a process comprising (1) separating from the cracked gas oil a lower boiling fraction; (2) hydrodesulfurizing the lower boiling fraction to produce a product which contains less than 300 ppm of sulfur; (3) separating from this product three more fractions, one of which contains dimethylnaphthalenes; (4) catalytically hydrogenating the latter fraction to an aromatics content of less than 3% (preferably less than 1%); and (5) distilling the hydrogenated product of step (4) to remove a fraction containing at least 90% dimethyldecalins. (Author abstract modified)

2609 APTIC NUMBER 20757

Kivelevich, Doris, James G. Dadura, and George W. Eckert
SMOKE SUPPRESSANT FUEL COMPOSITION. (Texaco Inc., New York, N. Y.) U. S. Pat. 3,499,742. 3p., March 10, 1970. (Appl. June 22, 1967, 11 claims).

Smoke from diesel engines is effectively suppressed by employing a hydrocarbon fuel containing minor amounts of a calcium alkylphenolate or sulfurized alkylphenolate overbased with calcium 2-methoxyethoxide alone of with calcium hydroxide-2-methoxy-ethoxide. These additives do not incur the serious operating disadvantages experienced with other calcium compounds, particularly calcium carbonate overbased calcium sulfonate. The calcium sulfurized alkylphenolates are prepared by reacting calcium alkylphenolates with elemental sulfur. The calcium alkylphenolate component must be used in combination with a basic calcium alcoholate or calcium alcoholate and calcium hydroxide to prove an effective smoke suppressing additive. The overbased calcium alkylphenolate additive is employed to provide a concentration of total calcium in the fuel ranging from about 0.01 to 0.4 weight percent calcium. The compound is added to a mixture of hydrocarbons boiling from about 35° to about 700 F. It is readily soluble at the concentrations used and can be mixed into the fuel in any convenient way.

[illegible] APTIC NUMBER 21117

[illegible]
[illegible] OPERATION AND [illegible] Berman, C., [illegible]

[illegible] development of the tornado-flow collector began in 1954. The first model consisted of a [illegible] pipe with a diameter of 75 mm and a length of [illegible] mm. A smaller inlet pipe protruded into the [illegible] in the bottom. Secondary air entered in the [illegible] of the pipe through a nozzle. The tornado flow consists of a [illegible] flow and a rotational flow in the center. The [illegible] flows [illegible] in [illegible] directions. Development of the first model was followed by experiments in a power plant. The collector was installed in the [illegible] to the electrostatic [illegible]. A collection efficiency of more than 90% was achieved with relatively fine dust particles. In 1963, two types of collectors of this kind were available: one with a capacity of [illegible] cu mph and one with 2750 cu m/h. However, the energy requirement of these units was too high. Through alterations at the inlet and outlet, the collection efficiency was further increased to 98% while, at the same time, energy consumption was reduced. High capacity units for 7500 and 12,000 cu mph became available. Presently, units with a capacity of [illegible] cu mph are in operation. Such collectors are particularly suited for the separation of fine dusts and can thus be used in foundries, in the stone industry, food industry, wood-working industry, as well as collecting pulverized synthetics. The various possibilities of regulating the secondary air current which controls the collection efficiency makes this versatility possible.

2611 APTIC NUMBER 20754

Kline, Millard R.
RETAINER FOR PURIFICATION MEDIA FOR GAS FROM SEWER LINE VENTS. (Assignee not given.) U. S. Pat. 3,475,885. 4p., Nov. 4, 1969. 15 refs. (Appl. May 2, 1968, 2 claims).

Building sewage systems are usually provided with vent pipes which extend vertically through the roof and through which germs and other impurities can pass. In densely populated areas, a significant amount of polluting agents are this emitted to the atmosphere. However, the often inaccessible location of the vent pipes has discouraged utilization of filtration means. A solution to these problems is offered by a three-part retainer which is adaptable to conventional pipes. The three parts are a cap, a cup-shaped container, and baffle means which includes an annular space filled with activated charcoal filters or a liquid cleaner-germicide-deodorizer. The annular space is disposed around the existing vent pipes so that the entire purifying medium is utilized without a portion of it becoming stale and ineffective while other portions go largely unused. The design facilitates replacement of the purifying medium. Moreover, the purifying element is so located that undue back pressure is not created in the vent pipe to adversely affect its ventilating function.

2612

APTIC NUMBER 20608

Klinksiek, Klaus Eckart
ON REDUCING THE EMISSIONS OF HARMFUL SUBSTANCES IN THE EXHAUST GASES OF OTTO ENGINES (PROBLEMS AND MEASURES TO BE TAKEN IN PRACTICE). Staub (English translation from German of: Staub, Reinhaltung Luft), 29(6):17-26, June 1969. 17 refs. (Presented at the conference on 'Problems of Scrubbing Exhaust Gases in Motor Vehicles' in Haus der Technik e.V., Essen, Nov. 6, 1968.)

Two complex factors affecting automobile development and construction are compliance with regulations within a fixed time period, including its effect on production scheduling, and the work involved in complying with different national 'design specifications.' Obtaining a technically feasible and economic reduction in emissions will probably lead to a renaissance in engine design, unless exaggerated legal requirements interfere with gradual technical development. To comply with the presently permitted limits of exhaust gases, the Volkswagen company had adopted the electronic control of gasoline injection and a specially designed carburetor with slide control. Determinations of the fuel requirements for an engine with electronically controlled gasoline injection are of special interest because exhaust gas analysis was chosen as the decisive criteria in determining engine characteristics. Measured fuel consumption at part load and five different pressures at the inlet pipe are graphically illustrated. The pulse duration, plotted as the abscissa, is directly proportional to the fuel consumption and is fed to the control instrument. Hydrocarbon and carbon monoxide emissions have minima, while the torque increases with the richness of the mixture. Circles indicate the operating parameters for which the engine was finally produced. Testing stages in the development of the engine are reviewed, together with special inspection measures. Because German law requires a check on total emission and on carbon monoxide emissions during idling, a modified bag procedure is used in inspection. The concentrations are measured integrally and official emission values for all countries are calculated with the aid of conversion factors. A special tester was developed for the in-service testing of vehicles with electronically controlled gasoline injection.

2611

APTIC NUMBER 20271

Kobayakawa, T., H. Koyama, and T. Nakahara
CONTROL OF NO FOR 2 STROKE CYCLE GASOLINE ENGINE. (2 Saikurugasorin Kikan no NO taisaku). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):88, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The traditional method of eliminating nitrogen oxides (NOx), harmful elements in automobile exhaust, has been to inject water simultaneously with the intake of air to recycle the exhaust gas. However, these only involved four-stroke engines rather than two-stroke engines where the concentration of nitrogen oxides is lower. A water-injection method for a two-cycle engine was developed and the results were reported. The average amount of nitrogen oxides contained in the exhaust gas was much lower with water-injection, thus opening a new possibility for a much cleaner two-cycle engine, although carbon monoxide and hydrocarbon content was not affected. With water injection, there was no appreciable increase in gasoline consumption, driving sensitivity, or acceleration. The position and the mechanism of the injector in the carburetor of the durability are yet to be improved for practical application.

2614

APTIC NUMBER 21311

Kokeisl, Theodor
FILTER AGGREGATE FOR SILOS, ESPECIALLY FOR DUST AND POWDER-FORMING LOOSE MATERIAL. (Filteraggregat an Silos, insbesondere fuer staub-und pulverfoermige Schuettgueter). Text in German. (Theodor Kokeisl, Aarau) Swiss Pat. 469,613. 3p., March 15, 1969. (Appl. April 3, 1968, 8 claims).

A filter aggregate for silos pneumatically charged with dusty and pulverized material has been devised consisting of a cylindrical connecting piece into which a cone is fitted. The lower part of the cone protrudes coaxially into the cylinder which is flanged at its bottom rim to the inlet of the silo. The horizontal pipe for pneumatical charging of the silo pierces the wall of the cylindrical connecting piece and terminates tangentially to the outside wall of the cone. The wide top end of the the cone is connected with the filter aggregate by a flange. The filter aggregate consists of concentrically arranged cylindrical screens of wire or cloth. A lid in the center leaves only the annular slots for the dust-laden air to pass. The material-laden air stream leaving the feed pipe tangentially to the cone begins to spin in cyclonic manner whereby all coarse particles are separated. The rising air carries this only fine particles into the filter aggregate where they are retained.

2615

APTIC NUMBER 20633

Kondo, S., N. Yamamoto, A. Watanabe, and S. Yanagisawa
COLLECTION EFFICIENCY OF SULFUR OXIDES. (Iwo sankabutsu no hoshukoritsu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):26, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Among sulfur oxides in exhaust gas, sulfur dioxide can be removed by passing it through water, but sulfur trioxide turns into sulfuric acid aerosol upon contact with water, thus making collection difficult. The effective absorption rates were measured for sulfur oxides by means of gas absorption, which was good for sulfur dioxide but not for sulfur trioxide. In addition, sulfur dioxide capture was attempted by means of an electrostatic vaporizer method, and the collection rate was about 94%. As for sulfur trioxide, the foam method was used to remove sulfuric acid aerosols at about 99.5% absorption rate; furthermore, the Cotterel method captured the sulfur trioxide gas and the aerosol almost entirely.

2616 APTIC NUMBER 20783

Kotera, Yoshihide
DIRECT DESULFURIZATION OF HEAVY OIL (MOVING BED SYSTEM). Chem. Economy Eng. Rev., 2(5):15-18, May 1970.

A Japanese pilot plant for fuel oil desulfurization switched from---

2617 APTIC NUMBER 20393

Kriegel, E.
STUDIES WITH MODEL CYCLONE SEPARATORS. PART I. EXPERIMENTAL RESULTS. (Modelluntersuchung von Zyklonabscheidern Teil I. Experimentelle Ergebnisse). Text in German. Tech. Mitt. Krupp, 25(1/2):21-30, July 1967. 19 refs. Part II. Ibid., vol. 25:31-36, 1967.

Model cyclones with different lengths, diameters, inlet cross sections, inlet design, installations, and dip pipes were used to measure the total dust collection efficiency, the pressure loss, and the collection efficiency for individual grain sizes. The influence of the cyclone geometry, the air entrance speed, and the dustload in the air stream on the efficiency were experimentally and theoretically determined. Quartz dust and cement meal were used for the experiments. The model cyclone was made of plexiglass for observation of the separation process. The quartz dust tended to agglomerate. Installations did not improve the collection efficiency, which increased with higher dust loads and higher entrance speeds. A range of almost constant collection efficiency extended from 0.8 to 1.3 m/sec at a dust load of 25 g/cu m (corresponding to a speed range of 15 to 24 m/sec in conventional cyclones). Since the pressure loss was proportional to the square of the entrance speed, it should be limited to 15 m/sec. A narrower dip pipe, smaller inlet cross section, and inclined inlet improved the total collection efficiency. The pressure loss is decisively determined by the inlet cross section. The pressure loss increases with increasing length of the dip pipe. These findings can be transferred to similar cyclones with Stokes parameter. Theoretical studies yielded similar results. Theoretically, the pressure loss and collection efficiency are determined by the geometry of the cyclone, Stokes parameter, and Reynolds number. The collection efficiency for certain grain sizes depends on the relationship of the diameter of the cylindrical cyclone section to the diameter of the dip pipe, and on Stokes parameter.

2618 APTIC NUMBER 21420

Kruegel, M. and H. Weber
EMISSIONS BY LIQUID GAS-DRIVEN VEHICLES. (Emission fluessiggasbetriebener Kraftfahrzeuge). Text in German. VDI (Ver. Deut. Ingr.,) Ber., no. 149:85-93, 1970. 4 refs.

Tests were performed with a 6-cylinder truck engine on a dynamometer driven with liquid gas and fuel. The hydrocarbon, carbon monoxide, nitric oxide, and nitrogen dioxide content of the exhaust was measured each time and compared. The liquid gas contained C_3H_8 and C_4H_{10}. Various fractions of these two substances were used. The flame ionization detector URAS was used for the measurements. The nitrogen oxides were determined with the phenol disulfonic acid method. Otto engines operated with liquid gas emitted less CO and nitrogen oxides as compared to fuel-driven engines, provided a higher amount of excess air is used at partial load operation of the engine. The liquid gas/air ratio may reach 1.9. The use of liquid gas would be desirable for reducing exhaust emission; however, it is limited. The refineries are geared to production of fuel oil and liquid fuel and convert only 2% of the crude oil into liquid gas. There is no dense network of liquid gas stations. In addition, liquid gas is uneconomical.

2619 APTIC NUMBER 21134

Kuliev, A. M., A. M. Tabatabai, G. Z. Alekperov, and R. B. Rul'kanov
USE OF METALLOCERAMIC FILTERS IN A FLUIDIZED-BED ADSORPTION UNIT. (K voprosu o primenenii metallokeramicheskikh fil'trov na ustanovke adsorptsii v kipyashchem sloe). Dokl. Akad. Nauk Azerb. SSR, 19(8):31-35, 1963. 5 refs. Translated from Russian by Elmar F. Wilip, Argonne National Lab., Ill., 5p., Feb. 1968.
CFSTI: ANL-TRANS-571

Metalloceramic filters were tested to determine their application in a semi-industrial adsorption unit with a fluidized bed in the petrochemical industry. These filters were fully effective replacements for more expensive cyclone spearators and electrofilters now used to remove dust from gas streams. This was accomplished without loss of the adsorbent. The pressure drop in the filter after its operation and subsequent blowing is not restored to the initial value at the same air consumption as required for the circulation. The increase of the pressure drop during the operation of the filter with coal dust amounted to 60-65 mm (water column) under the test conditions. Regeneration of the filters requires that they be blown through with large amounts of gas after a certain period of use.

2620 APTIC NUMBER 20755

Kulzer, Gene T.
FILTER BAG COLLAR. (Torit Manufacturing Co., St. Paul, Minn.) U. S. Pat. 3,475,884. 3p., Nov. 4, 1969. 27 refs. (Appl. May 9, 1966, 2 claims).

A simple and inexpensive method is provided of automatically and simultaneously producing rectangular frames for rectangular filter bags and filter collars over which the ends of the bags are folded. In the preferred form, the frames include a pair of parallel flattened tubes. The tubes are of equal length and are connected at opposite ends by U-shaped clips which provide sufficient weight at the lower corner of each bag to retain it in its vertical position. The collar which supports the upper end of each bag is formed of a pair of flattened tubes which are held

in parallel spaced relation by the U-shaped clips. The bags are sealed in a way to insure passage of air through the fabric rather tan between the bags. The collars can be assembled by an apparatus that holds the frame sides in parallel relation, inserts the end clips into the ends of the frame sides, and then crimps the frame sides to hold the clips in position.

2621 APTIC NUMBER 21515

Kurosawa, Ryuhei
ON THE DETERMINATION OF COLLECTING AND DETECTING EFFICIENCIES OF THE VARIOUS FILTERS BY ALPHA-SPECTROMETRY. Text in Japanese. Bull. Sci. Eng. Res. Lab. (Tokyo), no. 40:1-8, 1968. 7 refs.

The distribution of collecting particles in filters was studied by means of alpha energy analysis of alpha particles emanating from the filter surface, in order to determine filter efficiencies. Theoretical aspects of the problems are developed, and equations are derived to express both the collecting and detecting efficiencies. Experiments were conducted by collecting radon daughter products with various filters for 20 min from an aerosol of about 10000 particles per cu m, under a flow rate of 0.3 m/sec. The alpha activities and energy distribution due to captured 214Po in the filter were detected by a silicon semiconductor detector with a collimator. Size distribution of the attached particles was considered to be between 0.018 and 0.18 micron with a peak at 0.06 to 0.08. The distribution form of the aerosol particles in a filter was determined by applying experimental results to the derived formulae. Thus the following efficiencies were calculated: collecting efficiency for Toyo Roshi No. 5A, Millipore Ap-20, and membrane filter (pore size 0.4 micron) was 83.7%, 99.2% and 99.99% respectively; detecting efficiency for each of these filters, for the alpha ray of 214Po, was 32.7%, 45.0%, and 49.1% respectively. (Author abstract modified)

2622 APTIC NUMBER 21262

Kutsher, G. S., G. A. Smith, and P. A. Greene
NOW - SOUR-GAS SCRUBBING BY THE SOLVENT PROCESS. Oil Gas J., 65(12):116-118, March 20, 1967. 2 refs. (Presented at the National Gas and Petroleum Association, Annual Convention, Houston, Texas, March 14-15, 1967.)

Pilot-plant operating data spanning a wide range of sour gas compositions are presented to show the high physical absorption capacity of the dimethyl ether of polyethylene glycol for hydrogen sulfide, carbon dioxide, carbonyl sulfide, and mercaptans. The process, which involves the continuous cyclic absorption and desorption of acid gases, is similar to the typical aqueous amine system with the notable exceptions of externally supplied stripping gas (which eliminates a reboiler) and a refrigeration unit to cool the lean solvent. The bulk of acid gas is released in an atmospheric flash vessel located ahead of the stripper to allow close definition of solvent-regeneration requirements in the stripper. The solvent is easily regenerated by stripping with air or gas, the air requirement increasing slightly with decreasing absorber pressure. Preheating the fat solvent prior to entering the atmospheric flash tank provides the heat necessary for acid-gas release in the flash tank and stripper. The steam requirement for scrubbing 25 vol % H2S and 10 vol % CO2 feed gas in the pilot plant unit was 0.50 lb/lb acid gas, much lower than that required in aqueous amine processes. This low heat duty is attributable to air-stripping of a preheated solvent, the low specific heat of solvent (which is about half that of an aqueous amine), and low solvent circulation rates.

2623 APTIC NUMBER 20615

Lau, Hermann
AC ELECTROSTATIC PRECIPITATOR. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(8):10-13, Aug. 1969.

Dust can be separated in an electrostatic precipitator not only by direct but also by alternating current. To obtain separation, however, it is necessary to cover the large-surface electrode with an insulating screen. Laboratory studies with ac voltage led to good dust separation for highly sensitive dusts (omega greater than 10 to the 11th power ohm-cm). For dusts of higher conductivity, surface charge-assisted discharges occur in the ac precipitator along the surface of the insulating screen, and may damage the latter. Suitable materials for insulating screens are Teflon and polyphenylene oxide. A technical advantage of ac precipitators is that the weak adhesion of dust to plates enables particles to slide off without the need for rapping. Very coarse dust is sometimes deposited, but it rebounds. Consequently, a combination of a centrifugal separator and ac precipitator appears promising for coarse dust.

2624 APTIC NUMBER 21523

Lavilleon, Patrick De
MEMBRANE TANKS REDUCE LNG VESSEL COSTS. World Petrol., 39(7):41, July 1968.

The use of 'membrane' or 'integrated' cargo tanks for ocean transport of liquefied natural gas, as opposed to conventional self-supporting tanks, provides a capital saving of up to 15%, coupled with a small reduction in ship operating costs due to better utilization of the cargo space. A thin, flexible metal lining is used to contain the cargo, with the load being transferred to the ship's structure by means of load-bearing insulation. An integral and homogeneous insulation system is essential if unacceptable stress concentrations are to be avoided. The cost estimate for a new membrane tanker is $16-18 million, versus $21 million for a self-supporting tank vessel.

2625 APTIC NUMBER 21683

Lawes, Glen
A NEW ENGINE FOR THE CLEAN-AIR CAR? New Scientist, 47(708):12-13, July 2, 1970.

The technology available to decrease emissions from various

automobile engines is reviewed. It should be possible to achieve the 1975 Federal requirements without resorting to elaborate devices added to the exhaust system. After that, it will be almost impossible to avoid adding thermal reactors and catalyst beds to the exhaust train. Altering the engine to allow it to run on a richer or leaner fuel mixture can eliminate some of the hydrocarbons, oxides of nitrogen, and carbon monoxide from the exhaust. The diesel engine is, at present, the only potentially viable alternative to the internal combustion engine. The diesel has problems with smoke, smell, and noise, all of which must be cut down if the engine is to be used more extensively. Fuel supply would be a problem if the diesel engine became more widely used. Research in the development of electric and steam driven cars has not proven either type more attractive than the present one, except in specialized use.

2626 APTIC NUMBER 20307

Leapert, Frank L., Ernest Solomon, and Eugene F. Schwarzenbek
HYDROTREATING PYROLYSIS GASOLINE. (Pullman Inc., N. J.) U. S. Pat. 3,442,220. 10p., Jan. 27, 1970. 6 refs. (Appl. June 27, 1962, 27 claims).

Known processes for upgrading pyrolysis gasoline are not applicable to full-boiling range pyrolysis gasoline or require the use of inhibitors that add to process costs and may create a problem of ervine deposits. Moreover, the catalysts used in these processes require frequent regeneration or replacement. The present invention overcomes these limitations and is applicable to a full boiling-range gasoline containing C5 and lighter hydrocarbons and/or one containing styrene. Pyrolysis gasoline is hydrotreated with a sulfide nickel catalyst under conditions which produce either stable gasoline in a single zone or a substantially olefin-free, sulfur-free product in two or more reaction zones. The initial hhydrotreating zone employes relatively mild hydrogenation including relatively low teaperatures (350 - 475 ?). The two- and three-zone processes are directed to relatively more severe hydrogenation conditions without the serious problem of equipment fouling and catalyst aging. The absence of fouling appears to be due to the removal of diolefinic and acetylenic materials in the first hydrotreating zone. Suitable cayalysts for the second and third hydrotreating zones are oxides and sulfides of group VI metals supported on alumina and promoted by a group VIII metal cospound with an atomic number below 28. All the catalysts are responsive to standard regeneration techniques, even when the catalysts have become severely deactivated.

2627 APTIC NUMBER 20322

Lenane, Denis I.
EXHAUST SYSTEM. (Ethyl Corp., New York) U. S. Pat. 3,495,401. 6p., Feb. 17, 1970. 3 refs. (Appl. Oct. 23, 1967, 6 claims).

Particulates are removed from the exhaust gas of internal combustion engines by an exhaust system comprising a primary cyclone separator which operates at low exhaust levels in combination with a secondary cyclone separator which operates when the amount of exhaust gas exceeds that level efficiently handled by the primary separator. In a modified version, the primary conduit has an exhaust deflector immediately upstream from where the secondary exhaust conduit diverges from the primary conduit. This deflector functions to divert the exhaust gas stream from the secondary exhaust gas conduit so that the bulk of the exhaust gas flows to the primary cyclone separator until the back pressure in the primary conduit rises enough to cause some of the exhaust gas to follow the secondary conduit to the secondary cyclone separator. In another instance, a valve is provided in the secondary conduit which is closed when the volume of exhaust is low and efficiently removed of particulates by the primary cyclone. (Author abstract modified)

2628 APTIC NUMBER 20719

Lentz, Erwin C.
EXHAUST SYSTEM. (Walker Manufacturing Co.) U. S. Pat. 3,479,145. 8p., Nov. 18, 1969. 12 refs. (Appl. May 19, 1965, 13 claims).

An exhaust system is described embodying a catalytic converter that will reduce the amount of unburned hydrocarbons and effectively attenuate substantially all of the audible exhaust system noises without the necessity of providing a separate muffler. The catalytic converter comprises an outer shell having a substantially greater width than height, while an exhaust gas inlet flange is provided at one end of the outer shell and an exhaust gas outlet flange is provided at the other end of the outer shell. A catalyst bed is supported within the outer shell along its length and it comprises an elongated inner support member in communication at one end with one of the flanges. An elongated outer member is spaced from the inner member and defines a catalyst chamber in between. The members have a plurality of openings formed along their length so that exhaust gas may flow through a catalyst in the chamber in its path from the inlet flange to to outlet flange. Portions of the surface of the outer member at opposite side are spaced inwardly from adjacent portions of the surface of the outer shell to provide gas flow cavities. A resonator is provided in conjunction with the catalytic converter to attenuate the most objectional sound frequencies that are not attenuated by the catalytic converter.

2629 APTIC NUMBER 20312

Lindhole, Bengt and Gosta Mildh
EMITTING ELECTRODE ASSEMBLY FOR ELECTROSTATIC PRECIPITATORS. (Aktiebolaget Svenska Flaktfabriken, Stockholm (Sweden)) U. S. Pat. 3,501,898. 3p., March 24, 1970. 11 refs. (Appl. March 3, 1966, 3 claims).

A stable emitting electrode assembly is described for an electrostatic precipitator, in which contact pressure of sufficient strength is maintained and easy mounting and dismounting of individual electrodes is permitted. Electrode holders are provided for two of the side members of the frame, each of which comprises a mounting plate parrallel to the side member, while the plate has at least a first and second

aperture. The anchoring elements abut within the second aperture with a line contact between the element and the aperture so that the anchoring elements, due to the resilience of the electrode, are caused to press against the mounting plate only along the common abutment line. To reduce or prevent bending stress which may arise when the electrode is being connected to the anchoring element, the bore passage in the anchoring element is preferably flared, or formed with a rounded, slightly conical inlet.

2639 APTIC NUMBER 21307

Little, Donald M. and George E. Hattick
ABSORPTION OF SULFUR DIOXIDE FROM MIXTURES WITH SULFOLANE. (Phillips Petroleum Co., Bartlesville, Okla.) U. S. Pat. 3,475,329. 5p., Oct. 28, 1969. 12 refs. (Appl. March 27, 1968, 4 claims).

Process and apparatus are provided for the removal of relatively non-condensible materials from sulfur dioxide with substantially complete recovery of the sulfur dioxide of sufficient purity to allow its reuse as selective solvent in hydrocarbon extraction processes. By contacting mixtures of sulfur dioxide and relatively non-condensible materials with sulfolane, the sulfur dioxide is selectively absorbed in preference to relatively non-condensible materials having lower affinity for sulfolane. A solution of sulfur dioxide and sulfolane substantially free of the non-condensible materials is produced, and by a suitable fractionation process, sulfur dioxide is separated from the sulfolane. It is possible to employ several serial evaporation stages for the purification of both raffinate and extract phases and recovery of sulfur dioxide.

2640 APTIC NUMBER 21647

Loehr, J.
CONTRIBUTIONS TO EXPANDED GAS TURBO-CHARGING OF TRUCK DIESEL ENGINES. (Beitraege zur Abgasturboaufladung von Lastwagen-Dieselmotoren). Text in German. Automobiltech. Z. (Stuttgart), 72(2):37-44, Feb. 1970. (Presented at the Arbeitskreis Stuttgart der VDI-Fachgruppe Fahrzeugtechnik, Nov. 4, 1969.)

Until two years ago, turbo-charging was little used in Continental Europe for high-speed truck diesel engines, despite the many advantages. Introduction of a law requiring 2BF more per ton of truck weight made exhaust gas turbo-charged engines more attractive. Their advantages are that they save power, fuel, cost, and volume. Moreover, the quality of the exhaust gas is better. However, the cylinder-head gasket creates a problem. Only metal gaskets are used in the U. S. for this purpose. The piston, too, poses a problem. If an efficient cylinder scavenging is used, the piston temperatures increase over those of the non-charged engines through the higher process temperatures and the higher heat transfer because of higher ignition pressures. To avoid this, the ignition pressure must be decreased as far as possible, residual gas scavenging must be employed, a round, well-cooled cylinder nose must be used, and the piston skirt be cooled. Adaption of the turbo-charger to the gas throughput of the engine is governed by the power equilibrium between compressor and turbine. At present, it seems feasible to achieve mean pressures of 14 kg force/sq cm and a power to weight ration of 2.5 kg/HP or less.

2641 APTIC NUMBER 21350

Long, R. and S. F. Hay
INHIBITION OF THE FORMATION OF 3,4-BENZPYRENE DURING HYDROCARBON COMBUSTION. Nature (London), 192(4800):354-354, Oct. 28, 1961. 9 refs.

The present work was undertaken to determine whether the formation of the carcinogen 3,4-benzpyrene can be inhibited during hydrocarbon combustion. Since nitric oxide exerts a remarkable inhibiting effect on the chain-decomposition of some hydrocarbons, a substance was sought which would give rise to nitric oxide as a product of pyrolysis. Known amounts of nitroethane were introduced into a stream of commercial propane which was burned as a laminar diffusion flame in air. The air supply was reduced to give heavy soot formation in the absence of additive, and the soot was collected. A weighed amount of soot was extracted with chloroform, the solvent removed by distillation in a nitrogen atmosphere, and the residue extracted repeatedly with n-pentane. The extract was then filtered and the n-pentane removed in a nitrogen atmosphere; the residue was reported as mgs n-pentane-soluble material per 100 g of carbon input in the fuel plus additive mixture. The 3,4-benzpyrene content of the n-pentane-soluble material was determined. Small additions of nitroethane lead to a marked reduction in the formation of n-pentane-soluble material in the soot and in the amount of 3,4-benzpyrene.

2642 APTIC NUMBER 21568

Lord, R. C. and A. W. Weller
ALASCO COMPLETES FIRST YEAR WITH ONLY ROUTINE PROBLEMS. Oil Gas J., Vol. 64:78-80, 83-86, Aug. 15, 1966. (Presented at the American Gas Association Production Conference, Baltimore, Md., 1966.)

A brief technical description is given of a liquefied natural gas plant, including a review of the operating problems encountered in its first year of operation. The liquefaction section utilizes a propane-ethylene cascade system. Storage is above ground in double wall tanks. An amine unit sweetens the gas and two activated alumina driers remove the water. Some start-up problems were experienced with the compressor which were attributed to vibration. Heavy hydrocarbons in the cold box refrigeration loop caused some start-up problems there until they were eliminated. The most tenacious problem was the distribution of water and gas in the revaporizer heat exchanger. A minor system modification was required to correct the situation.

2634 APTIC NUMBER 20339

Lowicki, Norbert and Dietrich Mueller
PROCESS FOR THE REMOVAL OF SULPHUR FROM INDUSTRIAL GASES AND TO APPARATUS FOR USE IN SUCH A PROCESS. (Grillo-Werke A. G., Duisburg-Hamborn (West Germany)) U. S. Pat. 3,492,083. 14 p., Jan. 27, 1970. 9 refs. (Appl. Feb. 8, 1966, 44 claims).

Sulfur compounds which occur in smoke and waste gases as well as in other industrial emissions are removed by binding them to an absorbent; a method is provided by which the charged absorbent is capable of being readily regenerated for reuse in the absorption process. The technique is based on the observation that certain oxides, hydrated oxides, or hydroxides, are suitable absorbents, especially when in an essentially dry or only moistened highly active powder-form or small granular state. These oxide compositions are mixtures of alkaline earth metal compounds and alkali metal compounds, on the one hand, and on the other hand of amphoteric components, namely oxidic compounds of 2-,3- or polyvalent oxides are especially suitable. The absorbent charged with sulfur compounds is freed at least partially of its sulfur content in a dry regeneration at elevated temperatures, including a roasting stage, and the oxidic mass produced therein is hydrolyzed with water and then used again as an absorbent. By this method, the sulfur may be obtained as an important by-product in an economically usable form, preferably as SO2.

2635 APTIC NUMBER 21026

Lowicki, W.
THE GRILLO WASTE GAS DESULFURIZATION PROCESS. (Das Grillo-AGS-Verfahren). Text in German. VDI (Ver. Deut. Ingr.) Ber., no. 149:110-116, 1970.

The Grillo desulfurization process is based on chemisorption of the acidic sulfur components of waste gas. The absorbent consists of an oxide compound of magnesium oxide and manganese dioxide. It is highly active and can be easily regenerated. The magnesium-manganite, forms hydrates with water which react rapidly with acid gas components. The absorbent is regenerated by mixing with a reducing agent such as coal, sulfur or oil, than heating from 850 to 950 C. The absorbent is injected into the waste gas as suspension (pH 6.5 and 7) and the waste gas is separated into several flows. The consumption of fresh absorption suspension amounts to 1.4 to 1.6g/g SO2. The waste gas may have any SO2 concentration.

2636 APTIC NUMBER 20773

Luge, Karlheinz E. and Wolfgang Braun
METHOD FOR COOLING THE COMBUSTION GASES OF REFUSE INCINERATORS. (Metallgesellschaft A. G., Frankfurt (W. Germany)) U. S. Pat. 3,477,203. 3p., Nov. 11, 1969. 4 refs. (Appl. May 1, 1968, 7 claims).

A process is provided whereby the hot combustion gases of refuse incinerators may be readily cooled prior to their treatment in electrostatic dust separators, without unduly affecting the dew point of such gases or unduly increasing the volume of gases to be treated in the separators. In the first step, a cooling liquid is injected directly into the hot gases while they are still in the furnaces in the incinerator plants so as to lower the temperature of the combustion gases to about 600 C. In the second step, the temperature of the gases is further reduced to about 100-400 C by the infiltration of atmospheric air into the gases. The cooling liquid, usually water, is injected into the furnace under such conditions that it becomes and remains completely vaporized in the furnace so as to prevent the formation of sludge.

2637 APTIC NUMBER 21548

Lury, James De
LIQUEFACTION: NEW GAS MARKET. Chem. Eng., vol. 66:165-168, Dec. 14, 1959. 10 refs. (Presented at the Cryogenic Engineering Conference, Berkeley, Calif., Sept. 1959.)

New markets for natural gas are identified based on the capability to transport the gas to the market in a liquefied condition. Two methods of liquefaction, cascade and expansion cycle, are described and their efficiencies are compared. Where space permits, the cascade method is the more economical. Advantages of the more compact installation of the expansion cycle system are partially offset by its higher horsepower requirements and a lower percentage of deliverable gas per unit processed. The construction of a typical above-ground storage tank is described.

2638 APTIC NUMBER 20720

Lustenader, Edward L. and Frank W. Van Luik, Jr.
VORTEX-ELECTROSTATIC SEPARATOR. (General Electric Co., Schenectady, N. Y.) U. S. Pat. 3,478,494. 4p., Nov. 18, 1969. 11 refs. (Appl. June 26, 1968, 1 claim).

A compact vorter-electrostatic separator is described which is efficient and effective in the removal of particles of small size or mass as well as large size or mass from a flow stream without affecting the flow rate in the separator or introducing significant pressure drop therein. Particles in a flow stream are whirled toward the wall of a tube by a swirler which imparts swirling motion to the flow stream. The large particles tumble along the wall and pass out of the tube through slots to a collector; the small particles are thrown to the tube wall in a longer trajectory and tumble along the tube wall. As the particles pass in the electric field produced by a tubular grid, they become charged by corona discharge and are attracted by the tube wall. All the particles are directed into the slot and collector by a small portion of the flow stream which is diverted from the main flow stream in the tube for that purpose.

2639 APTIC NUMBER 20658

Magnet, Henri J. R.
PROCESS FOR GAS PURIFICATION. (General Electric Co., Lynn Mass.)

U. S. Pat. 3,489,670. 6p., Jan. 13, 1970. 8 refs. (Appl. July 29, 1964, 7 claims).

Utilizing ionic materials, such as polymeric ion exchange membranes and aqueous solutions of inorganic materials which form electrolytes, the rate of separation and the efficiency of the gas purification process may be increased by dissociating the gas to be treated and allowing the gas to migrate in ionic, rather than in molecular, form. An impure gas is charged into a fuel cell-type of apparatus comprising a catalytic anode, an electrolyte, and a catalytic cathode. Sufficient direct current energy is supplied between the electrodes to overcome the internal resistance of the cell, dissociate the gas to be treated, and drive the ionic form of the gas through the electrolyte for recovery at the opposite electrode. If a fuel cell apparatus is utilized, but electrical energy is supplied to the electrodes, rather than being derived through the electrodes as a result of a reaction, dissociation of a gas adjacent one of the catalytic electrodes will occur. When reactants are supplied to the two electrodes, for example hydrogen to the anode and oxygen to the cathode, electical energy is generated between the two electrodes and a by-product, water, is formed.

2640 APTIC NUMBER 20640

Mangum, Grafton F.
INJECTOR ASSEMBLY FOR ELIMINATING THE SMOKE TRAIL OF A SOLID PROPELLANT ROCKET MOTOR. (Thiokol Chemical Corp., Bristol, Pa.) U. S. Pat. 3,491,539. 3p., Jan. 27, 1970. 6 refs. (Appl. July 13, 1967, 1 claim.)

Smokeless solid propellants are being developed to provide smokeless and solid propellant rocket motors, but partial combustion of the organic liners and insulation used in the motors usually results in significant amounts of smoke under operating conditions. To eliminate the smoke trail, the present invention provides for the injection of a liquid oxidizer, e.g., N2O4, into the main exhaust stream of the rocket motor whereby any pyrolysis products are entirely combusted and consumed. The injector assembly includes a motor case containing the combustion chamber and a nozzle insert rigidly secured to the aft end of the motor case. A circular band secured to the outer surface of the nozzle insert serves as the container for the oxidizer. A sectional ringed-shaped piston is provided in the container. When the pressure of the combustion products causes the piston to move, the movement pressurizes the oxidizer which then breaks through a port in the nozzle insert to flow into the main stream of the rocket motor. The merging of the liquid oxidizer and main exhaust stream should eliminate any smoke trail.

2641 APTIC NUMBER 20432

Marchequet, Henri Georges Louis and Louis Gandon
PROCEDURE FOR EXTRACTING SULFUROUS GAS FROM A GAS WHICH CONTAINS IT. (Procede d'extraction de gaz sulfureux a partir de gas qui en renferment). Text in French. (Societe, Nobel-Bozel, Paris (France)) French Pat. 1,353,646. 3p., Jan. 20, 1964. (Appl. Jan. 18, 1963, 3 claims.)

A procedure is presented for extracting sulfur dioxide from a gas mixture which may contain, in addition to between 0 and 100% SO2, any other neutral or acid gases, such as CO2 or HCl. It uses an aqueous solution of glyoxylic acid, or another aliphatic acid of the aldehyde or the carboxyl group, as an extraction agent. The gas mixture is brought into contact with the acid solution, the concentration of which may lie between 1 and 60 weight % at a temperature between 0 and 50 C. The SO2-laden acid solution is heated to a temperature between 75 to 90 C, in order to release the SO2. Glyoxylic acid is commercially available as a crystallized monohydrate, HOOC-CHO.H2O, which melts at 58 C, is soluble in H2O in any proportion, and has a vanishingly low volatility. A particular advantage of its aqueous solution as an absorbing agent is that after many absorption-desorption cycles, it remains fluid, undiscolored, and retains its original strength. The neutral or acid gases of the gas mixture pass through it without any interaction, and no H2SO4 has ever been detected in it. The recommended temperature (20 to 25 C) for the absorption process is the best compromise between the increase of the absorptivity of the acid solution with decreasing temperature and the decrease of the rate of absorption by that solution, due to the concomitant increase of its viscosity.

2642 APTIC NUMBER 20952

45M THERMS PER YEAR. Marine Engr. Naval Architect, 1969: 560-566, Dec. 1969.

The design, construction, and operation of two tankers, the Methane Princess and Methane Progress, for transporting liquefied natural gas at -258 F from North Africa to England are described and diagrammed. The ships are the first in the world to carry the gas commercially, and will make about 60 round trip voyages per year, carrying 700,000 tons of LNG. This is equivalent to 45m therms or one-tenth of the country's annual gas requirements. The gas tanks are made of 5% magnesium aluminum alloy. The service speed, at 17-1/4 knots, is higher than that of a conventional tanker in order to shorten voyages, so that evaporation losses can be minimized, and because of higher capital costs. On a per ton carrying capacity basis, the capital cost ratio between a methane carrier and a conventional tanker is on the order of four to one at present; on a thermal basis, this ratio would be just over three to one. The capacity of the methane tanks on each ship is 978,253 cu ft. Insulation, instrumentation, and the dual fuel boiler system are discussed. The estimated boil-off rate is about one-third per cent per day of the cargo on a loaded voyage; the gas is collected and discharged to the boilers for use as fuel.

2643 APTIC NUMBER 21242

Markbreiter, Stephen J. and Irving Weiss
EXPANDER CYCLES FOR LNG. Cryogenic Eng. News, vol. 3:46-47, 57, March 1968. 1 ref.

Expander cycles are used on 5 of the 12 domestic liquefied natural gas (LNG) facilities. The concept of these expander

cycles is that liquefaction of gas supplied at an elevated pressure is achieved by utilizing the energy in the gas to generate refrigeration. A favorable aspect of the open expander cycle is that only the stream to be liquefied needs to be purified. The major portion of feed gas need only be dried. The maximum quantity of net LNG that can be produced in an open expander cycle is a function solely of turbine efficiency, once all other process parameters are fixed. There are a number of expander cycle variations that can be adapted to conditions other than those discussed.

2644 APTIC NUMBER 21542

Marshall, H. T. and C. Johnson
AUTOMATED PORTLAND LNG PLANT HAS MANY UNIQUE DESIGN FEATURES. Am. Gas. J., 194(10):21-24, Dec. 1967.

A new liquefied natural gas peak shaving facility is characterized by a turbo-expander liquefaction cycle producing a net daily liquefaction rate of 2.45 MMcf and a double-wall storage tank with a 175,000 bbl capacity. The liquefaction cycle is designed to allow expander discharge gases to exhaust from the system to two separate distribution mains with different operating pressures and varying flow rates. The entire feed stream is dried and carbon dioxide is removed from only the liquefaction stream. The dehydration and CO2 removal units each consist of two-bed molecular sieve systems, one bed used for adsorption while the other is being regenerated. A special dehydrator regeneration gas retention system is provided to reduce and stabilize sulfur releases to the distribution feeders. The inner storage tank has a suspended roof which supports thermal insulation and serves as a thermal barrier while permitting natural gas vapors to permeate the roof and shell insulation space. A plant sendout system automatically pumps and vaporizes liquid from the storage tank at rates up to 60 MMcf per day. The facility is completely automated, with remote control provided at a dispatch center 10 miles away. At the center, a gas chromatograph, sulfur analyzer, CO2 analyzer, and hygrometer monitor the stream at strategic points in the pre-treatment, liquefaction, and sendout facilities.

2645 APTIC NUMBER 20504

Washburn, James C., and Robert T. Sylvester
ACTIVATED CHARCOAL FILTRATION: A SUPPLEMENT TO HEPA FILTRATION IN CLEAN ROOMS AND WORK STATIONS. Sandia Labs., Albuquerque, N. Mex., Contamination Control and Process Acceptance Div., 21p., June 1969. 14 refs.
CPSTI: SC-DR-69-316

Type AC activated charcoal filter was tested for efficiency in removing gaseous contaminants, particularly from smog and from clean rooms in conjunction with a high-efficiency particulate air (HEPA) filter for particulate removal from these environments. The experimental clean bench designed and constructed for the experiments is described. The combination system can economically eliminate Freon 12 gas (and, by extrapolation, other gaseous vapors) as well as particulates. An optimal work station with combination HEPA/charcoal filters would recirculate the clean air to minimize the loading of both types of filters.

2646 APTIC NUMBER 21196

Masologites, George P., Harry F. Jacobs, and Paul J. White
PROCESS FOR REMOVAL OF SULFUR AND METALS FROM PETROLEUM MATERIALS. (Atlantic Richfield Co., Phila., Pa.) U. S. Pat. 3,472,759. 6p., Oct. 14, 1969. 4 refs. (Appl. April 25, 1967, 10 claims).

A process for treating a petroleum material containing a residuum fraction in order to remove sulfur and metal compounds and to produce a naphtha fraction suitable for use as an ethylene stock charge and a low sulfur content fuel oil is described. The process involves subjecting the petroleum product at a high temperature and high pressure to hydrocracking in the presence of hydrogen and a catalyst to produce a hydrocracked product. That product is then hydrodesulfurized at a high temperature and high pressure in the presence of hydrogen and a highly active catalyst, and then fractionated to obtain a naphtha product, a furnace oil, and a heavy fuel oil. The furnace oil is then recycled to increase the yield of the naphtha product. (Author abstract modified)

2647 APTIC NUMBER 20497

Masologites, George P., Harry F. Jacobs, and Paul J. White
TWO-STAGE TREATMENT OF HIGH SULFUR CONTENT PETROLEUM MATERIALS. (Atlantic Richfield Co., Phila., Pa.) U. S. Pat. 3,477,943. 5p., Nov. 11, 1969. 5 refs. (Appl. April 25, 1967, 5 claims).

A two-stage process is described for removing sulfur from topped or reduced petroleum residuum fractions and obtaining high yields of naphtha suitable for use as an ethylene charge stock and heavy fuel oil of low sulfur content. In both stages, the material treated is maintained largely in the liquid phase. In the first stage, the charge stream is subjected to hydrodesulfurization at 650-850 F and between 500-5000 psig in the presence of oxides and sulfides of Group VI metals such as tungsten, chromium, or molybdenum, or iron group metals. The catalysts are composited with an activated alumina prepared by drying and calcining an alumina hydroxide containing 1.2-2.6 moles of water of hydration. The total effluent from the hydrodesulfurization stage is subjected to hydrocracking in the presence of oxides and sulfides of cobalt, molybdenum, nickel, tungsten, or mixtures of these elements, deposited on an amorphous alumina support, at 700-1000 F and 500-5000 psig. The resulting hydrodesulfurized, hydrocracked materials is then fractionated by conventional means to obtain a hydrocarbon fraction boiling in the naphtha range.

2648 APTIC NUMBER 20887

Massey, P. S.
HOW PHILLIPS BUILT FROZEN EARTH PROPANE STORAGE. Pipe Line Ind.,

vol. 20:54-55, April 1966. (Presented at meeting of the Natural Gas Processors Associations, New Orleans, La., March 11, 1966.)

A 161,000-barrel frozen earth propane storage facility built at a Utah petroleum refinery in 1963 is described. The facility consists of an unlined pit excavated at the earth's surface within an artificially frozen ring, and covered with an insulated, steel, gas-tight roof. A refrigeration system using the stored product as the refrigerant is employed to condense boil-off vapor from the pit itself and the vapor generated when the incoming stream is flashed to storage temperature. The pit operates at a pressure of about 6 in. of water and a temperature of minus 56 F. Before design and construction begin, it is imperative to have a thorough and accurate analysis of soil conditions at the site being considered. Frozen earth storage shows potential as an economically attractive method of storing propane where circumstances are favorable, although minimum investments for refrigerated above-ground investments are not a great deal higher. Operating costs are higher than above-ground costs initially, but drop below the cost for an ordinary single wall insulated above-ground tank within a few months and continue dropping until an equilibrium point is reached.

2649 APTIC NUMBER 21202

Mayland, Bertrand J. and Robert John Steinberger
APPARATUS FOR REMOVAL OF ACIDIC GASES FROM GASEOUS ATMOSPHERES. (Girdler Corp, Louisville, Ky.) U. S. Pat. 3,485,743. 5p., Dec. 23, 1969. 4 refs. (Appl. July 21, 1967, 4 claims).

An apparatus is described for the removal of carbon dioxide from air. Variations of the described technique are suitable for the removal of CO_2, hydrogen sulfide, hydrogen cyanide, and similar acid gases from other gaseous atmospheres such as natural gas. Additionally, a significant saving in space as compared to that used by existing equipment to do an equivalent job is claimed. Air containing a greater than desired quantity of CO_2 is passed through an absorber tower of comparatively small dimensions where it is scrubbed by a water solution of potassium carbonate containing a small amount of free potassium hydroxide. The scrubbed air is carried by a conduit to a cooling means and a means for treating it with oxygen, if desired. Spent absorber is conducted from the absorber tower to an electrolytic cell for regeneration. Three configurations of electrolytic cells are described. The absorbing solution is cooled after regeneration and returned to the scrubber tower for re-use.

2650 APTIC NUMBER 21549

Mayo, F.
THE STORAGE OF LIQUEFIED HYDROCARBON GASES. Inst. Petrol. Rev. (London), vol. 19:284-292, July 1965. 4 refs.

Aspects of storing a range of liquefied hydrocarbon gases are discussed and include: early storage developments, the 1944 Cleveland disaster, general considerations of cryogenic storage, low-temperature metals, types of insulation, safety considerations, low-temperature storage, pressure storage for liquid propane, and comparative costs. A refrigerated liquefied gas storage involves cooling and liquefying the incoming gas, storing it, keeping the storage cool, and heating the liquid to convert back to gas for delivery. Steels with a 9% nickel content are now in general use as material for these applications. Insulation is of vital importance, not only to the effectiveness and economics of low temperature storage but also to its safety in case of fire. Properties and relative costs of some popular insulants are compared. Safety provisions include siting, spacing, and diking of storage vessels, adequate venting and pressure relief, suitable fire protection and liquid alarms to prevent overfill. Recent trends have been away from spheres and toward vertical cylindrical tanks operating at near-atmospheric pressure, as well as toward greater tank sizes and cryogenic inground excavations for liquid methane. Leached salt caverness and mined caverns are in common use for liquid propane storage. In cost terms, unrefrigerated pressure vessels are suitable for the storage of C_3 and C_4 hydrocarbons in quantities under 10,000-20,000 brl; when dealing with larger volumes, refrigerated or subterranean cavity storage is more economic. Frozen earth storage also appears to have significant cost advantages.

2651 APTIC NUMBER 20275

McGee, John J., Tom J. Kelly, and John N. Harman
SCRUBBER METHOD AND APPARATUS. (Beckman Instruments, Inc., Fullerton, Calif.) U. S. Pat. 3,495,948. 5p., Feb. 17, 1970. 2 refs. (Appl. June 26, 1967, 14 claims).

A solid phase chemical scrubber for removing ozone from a gas stream containing sulfur dioxide is described. The scrubber is intended for use with an SO_2 analyzing instrument which is sensitive to both ozone and SO_2. The scrubber contains either alkylthio mercury chloride, dialkylthio mercury, alkylthio lead chloride, or dialkylthio lead. When a gas stream is passed through the scrubber prior to delivery to an SO_2 analyzer, the ozone in the gas chemically reacts with the compounds to produce a sulfonic acid derivative. By adding mercuric or lead chloride to the scrubber, mercaptans and hydrogen sulfide are also chemically removed.

2652 APTIC NUMBER 20307

McClintock, William A. and Leo L. Politte
RECOVERY OF SULFUR AND HYDROGEN SULFIDE FROM ADMIXTURE WITH SOLVENT FROM GAS WELL BY PLURAL STAGE DISTILLATION OF SOLVENT. (Phillips Petroleum Co., Bartlesville, Okla.) U. S. Pat. 3,498,887. 7p., March 3, 1970. 11 refs. (Appl. Dec. 18, 1967, 4 claims).

A gas well producing principally hydrogen sulfide, carbon dioxide, and free sulfur is produced by pumping a solvent, e.g., benzene, into the well to dissolve free sulfur; the solvent is recovered for recycle by fractionation and steam distillation. Fractionation yields substantially benzene-free hydrogen sulfide and carbon dioxide overhead, which are passed to a sulfur producing plant; the bottom fractions are flashed and steam distilled to obtain

benzene overhead, which is reused, and molten sulfur as bottoms. In a typical hydrogen sulfide gas well, it is possible to obtain enough acid to produce about 90-100 tons/day of sulfur. (Author abstract modified)

2653 APTIC NUMBER 20724

McDermott, Lyle C.
AIR POLLUTION ELIMINATION APPARATUS. (Assignee not given.) U. S. Pat. 3,486,307. 3p., Dec. 30, 1969. 10 refs. (Appl. Jan. 10, 1968, 4 claims).

A gas washing apparatus is described which results in a much faster and more thorough saturation of carbon particles and other harmful pollutants and substances. There are two vertically spaced, sloping flat-like tubular members with relatively small perforations extending transversely through their top and bottom walls. These highly polished perforated stainless steel plates insure a smooth and rapid flow of the liquid circulated. As the compressed smoke and pollutant gases accumulate in the space above the liquid level in the liquid reservoir and below the first perforated tubular member and between the two tubular members, they are forced into the cross flow of liquid passing between the top and bottom walls of each perforated tubular member. The upper tubular member maintains a uniform flow of water between its upper and lower perforated plates. The lower tubular member with its perforated bottom and top walls interrupts the smoke and gases as they are forced into and through the relatively very tiny gas and smoke bubbles which pass upward and out of the liquid flow. The gas or smoke pressure contained inside of the bubble protects the carbon and other impurities from becoming sufficiently saturated with liquid and therefore the smaller the bubbles, the faster the carbon particles and other impurities become saturated or liquid logged which is necessary before they will settle to the bottom of any reservoir.

2654 APTIC NUMBER 21001

McElrath, R., Jr.
HIGH-EFFICIENCY DUST COLLECTING FOR LIGHTWEIGHT AGGREGATE PRODUCTION. Rock Prod., 73(6):56-59, June 1970.

The sources of dust pollution in lightweight aggregate plants can be divided into three broad categories: (1) raw feed preparation; (2) burning process; and (3) product handling. Dust from the burning process is a mixture of burned and unburned feed. This variation can be a source of trouble in the collection process. Disposition of collected dust should be economically beneficial. The three main types of dust collectors are electrostatic precipitators, scrubbers, and glass bag collectors. A comparison of capital cost requirements for each of the three types is different because the cost varies with plant requirements and conditions. Ductwork design is an integral part of the system. Design and operating characteristics for the three types of collectors are reviewed.

2655 APTIC NUMBER 21418

McJones, R. W. and R. J. Corbeil
NATURAL GAS FUELED ENGINES HAVE LOWER EXHAUST EMISSIONS. S.A.E. (Soc. Automot. Engrs.) J., 78(6):30-34, June 1970.

Exhaust emission data for dual-fuel automobiles running on natural gas were obtained for six engine classes in chassis dynamometer tests. The data show that the exhaust emissions for these cars are below most existing and proposed standards, including California's proposed 1975 standard. Both carbon monoxide and reactive hydrocarbons are well within prescribed limits which equal or surpass the California 1975 standard. Oxides of nitrogen are marginally within the standard, except for a 440-cu in engine. In all cases, emissions with natural gas are below the emissions of the same engines run on gasoline. In addition to the substantial reduction in exhaust hydrocarbon concentrations, there is an equally important shift toward nonreactive compounds. This lowering of exhaust hydrocarbon reactivity is primarily due to the preponderance of methane which has a zero activity in photochemical smog production. With the dual-fuel system, evaporative hydrocarbon emissions from the carburetor and fuel tank are nearly zero. The dual-free system is schematically illustrated. The heart of the system is a variable venturi mixer mounted on the carburetor. The venturi meters the correct quantity of natural gas into the airstream over the full range of engine airflow demands. A single mixer model covers all engine classes and involves no internal engine modifications.

2656 APTIC NUMBER 20995

McLaren, J. and D. F. Williams
COMBUSTION EFFICIENCY, SULPHUR RETENTION AND HEAT TRANSFER IN PILOT PLANT FLUIDIZED-BED COMBUSTORS. Combustion, 41(11):21-26, May 1970. 10 refs. (Also: Engineering (London), 27(5379), May 1969.)

As part of a research program into the combustion of coal in a fluidized bed for large-scale power generation, measurements of combustion efficiency and retention of sulfur by limestone were made in an 0.15-m diameter bed. Both reactions were taken virtually to completion during combustion of -10 BSS mesh coals at 900 C in a 0.6-m deep bed of ash fluidized at 0.6 m/s, when elutriated fines were recycled to the bed. In addition, experiments in an 0.3-m square combustor bed showed that bed-tube heat transfer co-efficients of 460 W/ sq m C (80 Btu/sq ft h F) can be achieved under these conditions, indicating that a large reduction in tubing costs should be possible. Further experiments in a 0.9-m sq cold bed on the effect of tube orientation on heat transfer indicate that it should be possible to pact the tubing required under these conditions into an 0.6-m deep bed. (Author abstract modified)

2657 APTIC NUMBER 20780

McRae, Wayne A., Daniel L. Brown, and Stuart G. McGriff
RECOVERY OF SULFUR DIOXIDE FROM GAS STREAMS. (Ionics, Inc., Watertown, Mass.) U. S. Pat. 3,475,122. 10 p., Oct. 28, 1969.

2 refs. (Appl. March 22, 1967, 10 claims).

A continuous self-regenerating liquid-phase absorption system is described, employing a novel combination of four basic steps for controlled stack gas purification. The first step involves the electrolytic conversion of an ammonium or alkali metal sulfate salt into its corresponding acid and base. The second step involves the absorption of sulfur dioxide from the gas stream into the aqueous basic solution to form predominately bisulfite solution. The third step is directed to neutralizing the spent caustic containing the bisulfite with the electrolytically produced acid to reform the original alkali metal salt and recover the sulfur dioxide. In the fourth step, this salt solution is reclarified and recycled with or without concentration or dilution as feed to the electrolytic cell and again electrolytically converted to the acid and base. During the neutralization step, the SO2 is desorbed from the spent caustic and is collected as a valuable chemical which, for example, may be ultimately converted to sulfuric acid.

2658 APTIC NUMBER 20292

Messinger, Harry and Joseph F. Daly
ION EXCHANGE PROCESS AND APPARATUS FOR CONTINUOUS REMOVAL OF GASES. (Assignee not given.) U. S. Pat. 3,498,026. 4p., March 3, 1970. 6 refs. (Appl. June 24, 1968, 8 claims).

An arrangement for removing contaminated gases from the atmospheres of closed environments is described. An endless belt fabricated from a porous or fibrous material, chemically treated to adsorb carbon dioxide or other gases from the surrounding atmosphere, is utilized. The endless belt or ionic screen is preferably a self-supporting adsorbent material, such as, an anion exchange resin or polymeric anion, which can be wound over rollers. The moving belt, after adsorbing CO2, enters a zone of hot water which causes the adsorbed gas to be released. (Author abstract modified)

2659 APTIC NUMBER 21610

Mikus, H. J.
CRYOGENICS AND THE PLATE-FIN EXCHANGER. Cryogenic Eng. News, vol. 2:20-22, Sept. 1967.

The advantages to cryogenic range heat exchangers of aluminum as a material and the plate-fin design as a geometry are presented. Listed aluminum advantages are light weight, high thermal conductivity, and improvement of tensile strength at cryogenic temperatures. These factors combine to permit compactness which is enhanced by the plate-fin design as compared to the more conventional tube-and-shell design. The plate-fin design also permits flexibility in multi-streaming or passing a variety of fluids through different channels in the same heat exchanger. Trade-off parameters to be considered in heat exchanger design are identified and discussed. Industrial process application involving gas separation, purification, or liquefaction in the low temperature ranges can benefit from the advantages in overall size, design flexibility, and cost offered by brazed aluminum plate-fin exchangers. These exchangers are now being used for helium liquefaction, helium extraction from natural gas, hydrogen purification and liquefaction, air separation, ethylene recovery, and natural gas liquefaction and revaporization.

2660 APTIC NUMBER 20696

Miller, Leo A. and Jack D. Terrana
PROCESS FOR RECOVERING SULFUR DIOXIDE FROM GASES CONTAINING SAME. (Wellman-Lord, Inc., Lakeland, Fla.) U. S. Pat. 3,485,581. 5p., Dec. 23, 1969. 8 refs. (Appl. Nov. 15, 1966, 20 claims).

The concentration of sulfur dioxide in stack or furnace gases from coal-burning furnaces in electric power plants is often less than 1%. Conventional water-scrubbing processes are generally unsuitable for such small concentrations. In accordance with the present invention, SO2 concentrations as low as 0.3% can be recovered by scrubbing the gases with an alkali or alkaline earth metal sulfite, e.g., sodium or potassium sulfite, to convert the latter to bisulfite; evaporating at least some of the water from the bisulfite solution at temperatures below the decomposition point of the bisulfite; and then heating the bisulfite to above the decomposition point to obtain SO2 and the mono-sulfite, which can be recycled. The process can be carried out in a packed tower or a plate tower containing bubble trays or sieve plates. The reaction zone temperature is between 100 and 230 F and the decomposition zone temperature, between 230 and 600 F. During the evaporation step, it is advantageous to replace the water being removed with an inert heat exhange material which is liquid under the evaporation zone conditions; the material is used in amounts sufficient to yield a slurry of the bisulfite in the material. (Author abstract modified)

2661 APTIC NUMBER 21186

Miller, Leo A. and Jack D. Terrana
PROCESS FOR RECOVERING SULFUR DIOXIDE FROM GLUE GAS. (Wellman-Lord, Inc., Lakeland, Fla.) U. S. Pat. 3,477,815. 5p., Nov. 11, 1969. 3 refs. (Appl. Nov. 15, 1966, 11 claims).

A sulfur dioxide-containing gas, such as flue gas, is scrubbed with an aqueous solution of an alkali metal or alkaline earth metal sulfite, e.g. sodium sulfite, to absorb the SO2 and form the bisulfite. The spent absorbing solution is conveyed to a desorption zone where it is heated to effect reversion of 50-70% of the bisulfite back to the sulfite, water, and SO2. That portion of the bisulfite which is not decomposed in the heating step is reacted with the corresponding metal carbonate to yield more metal sulfite, water, and carbon dioxide. The resulting metal sulfite solution is then recycled to the absorption zone. (Author abstract)

2662 APTIC NUMBER 20531

Mills, Kenneth
THE MOTOR VEHICLE SERVICE INDUSTRY'S ROLE IN CONTROLLING MOTOR VEHICLE POLLUTANT EMISSIONS. Preprint, 8p., 1969.

Surveillance of production vehicles in routine public operation indicates that many of the cars do not operate at the emission levels which were established by the prototypes used for pre-production certification. Reasons suggested for this disparity include problems in translating prototype designs to production configurations, production quality control, quality control at the dealership, and after-market maintenance in the service garage. An understanding of the emission control modifications or devices added to the car, the role they play, and the importance of adhering to tune-up specifications are stressed in the area of maintenance quality control.

2663 APTIC NUMBER 20436

(Inventor not given.)
PROCEDURE FOR PRODUCTION OF SULFURIC ACID. (Procede de production d'acide sulfurique). Text in French. (Mitsubishi Shipbuilding and Engineering Co., Ltd., Japan) French Pat. 1,348,923. 7p., Dec. 2, 1963. (Appl. Feb. 28, 1963, 5 claims.)

Two procedures are presented for producing sulfuric acid from a gas containing sulfur oxides and from a suspension. In the first case, the gas is brought into contact with an aqueous suspension of a manganese oxide, of a concentration at which it remains fluid, to form MnSO4. If the latter reacts with HCl, H2SO4 and a crystalline precipitate of MnCl2 are formed. In the presence of O2 and H2O vapor at an elevated temperature, MnCl2 decomposes into HCl gas and a Mn oxide, which are returned to the operations of H2SO4 formation and MnCl2 precipitation and of preparation of an aqueous suspension of a Mn oxide. In the second case, from an aqueous suspension of crystalline MnSO4, a gas containing hydrochloric acid is introduced into the aqueous suspension at a temperature not exceeding 50 C and, preferably, at ambient temperature to produce H2SO4 and crystalline MnCl2. After separating the latter from H2SO4, it is reacted with a gas containing O2 and H2O vapor at a temperature between 350 and 600 C in order to oxidize it to HCl and a Mn oxide. The resulting gas containing hydrochloric acid is re-used for production of MnCl2 from MnSO4. In addition, a hot gas containing hydrochloric acid produced in the oxidation of MnCl2 is used to eliminate HCl remaining in H2SO4 after its separation from MnCl2. This gas is cooled in an indirect heat exchanger by transferring its heat to H2SO4, yet to undergo the HCl elimination treatment. Air is brought into contact with the HCl-bearing H2O condensate of that heat exchanger to obtain air containing HCl and H2O vapor to be used for MnCl2 oxidation.

2664 APTIC NUMBER 21677

OFFENSIVE ODOURS FROM MEAT PACKING PLANT ELIMINATED IN TWO STAGE AIR WASHING SYSTEMS. Mod. Power Eng., 68(6):78-79, June 1970.

Air pollution in meat packing plants comes mainly from the odors created in the processing of animal carcasses and in the refining of oils. A system to control offensive odors is described. The system involves washing the odorous air with chlorine-treated water in a two-stage process. Individual treatment of different odors produced is accomplished through different types of air washes for the stronger odors, and with air make-up units for dilution of the weaker ones. A classification of the types of odors produced is included, as well as other possible treatment methods. The system described is almost 100% successful in eliminating odors, and is used as a model for other odor control systems.

2665 APTIC NUMBER 21734

Molyneux, F.
CRYOLITE FROM FERTILISER WASTE GASES. Australian Chem. Process. Eng. (Sydney), 24(1):29,31,33,35,37,39, March 1970. 27 refs.

The performance of the venturi jet scrubber as used in the treatment of effluent gas from phosphate rock acidulation is analyzed. Due to the corrosive nature of the gas, the simple construction of this unit enables it to be fabricated out of plastic or other non-corrosive materials. Theoretical and experimental performance characteristics are determined for fluorine recovery. Average fluorine recovery was 97%. This type of control device may be applicable to the recovery of aluminum trifluoride and synthetic cryolite from phosphate fertiliser and aluminum refining industry.

2666 APTIC NUMBER 21795

Montgomery, William T. S.
BOILER FUEL RECLAMATION SYSTEM. (Jacksonville Blow Pipe Co., Fla.) U. S. Pat. 3,489,111. 11p., Jan. 13, 1970. 3 refs. (Appl. Oct. 6, 1967, 34 claims).

In many industrial operations, boilers are fueled by burning bark which is often obtained from trees growing in sandy country where the bark grows over the sand so that the sand permeate throughout the bark. The sand is carried about by hot gases within the boiler firebox and is caught in the dust collectors catching the char and is then reinjected into the firebox of the boiler along with the char. The boiler fuel reclamation system includes a separator for removing sand from fly ash charcoal in a wood or bark burning boiler and a novel system for employing stack gas or air to convey sand or fly ash charcoal through the separator and for returning the charcoal to the boiler firebox. A programmed double dump valve unit facilitates the gravity discharge of light sand and fly ash charcoal from the low pressure area of a collecting hopper into the high pressure area of a gas conveying tube. (Author abstract modified)

2667 APTIC NUMBER 20302

Moragne, Edward L.
AIR CLEANER. (Assignee not given) U. S. Pat. 3,494,108. 7p., Feb. 10, 1970. 15 refs. (Appl. March 14, 1968, 10 claims).

A cleaning solvent spray apparatus is described to remove accumulated impurities from air filtration material disposed in a vent hood structure. When meat and other foods having a high grease content are cooked, the vapors which are produced contain large amounts of grease and oil that accumulate in the exhaust systems where they present a significant fire hazard. Baffles direct the vapors through the filtration material and confine the cleaning solvent as it passes downward through the hood. A conveyor means drains the solvent and removes impurities from the hood to a settling container where the cleaning solvent is separated from the impurities and is automatically returned to the hood and recirculated over the filtration material. (Author abstract modified)

2668 APTIC NUMBER 20478

Morandi, Gino
INDUSTRIAL LIQUEFACTION OF METHANE AND ITS APPLICATIONS.
(La liquefazione industriale del metano e le sue applicazioni).
Text in Italian. Riv. Freddo, 1940:387-392, Nov. 1940. 37 refs.

Previous studies of the liquefaction of pure methane are extended to the liquefaction of gas mixtures containing industrial methane, its storage, transportation, and eventual conversion to compressed liquid methane for use as an automotive fuel. Types of methane from various sources are considered; by-products of the fractionation of illuminating gas and coking gas, from natural gas, and from the fermentation products of urban waste. The latter gas in its raw form has a 25% carbon monoxide content and requires 0.30 horsepower-hours/kg of unrefined gas for scrubbing with water; the theoretical energy of liquefaction is 1.3-1.6 hp-hrs/kg. The Municipal Transport Agency of Milan, Italy, has adopted a special cylinder for the compressed gas, made of a special nickel-chromium-molybdenum steel alloy with a low tare value of 4 kg/cu m, which becomes more economical than the conventional cylinder for long range transportation (90-180 km and even 200-320 km).

2669 APTIC NUMBER 21558

Morgan, Robert B.
ROW TO SELECT CRYOGENIC INSULATION. Petro/Chem. Engr., vol. 40: 56-58, July 15, 1968.

Economics of insulating materials for storage at cryogenic temperatures are divided into two categories. When vessel diameter exceeds 10 ft, relatively inexpensive inorganic materials are used. Small vessels with larger area to volume ratios may be more economically insulated with the "super-insulating" materials. Perlite is used for the majority of large vessels because of its many desireable properties. Organic materials are expensive, hard to remove, flammable, and variable in property. A problem with perlite is its tendency to compact under thermal cycling. Super-insulating materials include aluminum foil in glass cloth or netting, aluminum coated granular ceramics, and chopped copper wire-inorganic matrices. Heat loss factors through insulating materials are described.

2670 APTIC NUMBER 21205

Morse, Tony
ULTRASONICS CAN HELP CLEAN UP THOSE EXHAUST FUMES. Engineer (London), 230(5954):31-33, March 5, 1970.

Research into ultrasonic atomization in England has slowed considerably, due to a lack of funding by industry. Tests on internal combustion engines have shown that an ultrasonic fuel atomizer would decrease both fuel consumption and exhaust emissions, but legislation needs to provide the incentive for its adoption by the industry. Two theories to explain the mechanism of atomization are the cavitation hypothesis and the capillary wave theory. The basic types of generators are the magneto-stricture oscillator and the piezo-electric generator. The trend is toward the latter, which is capable of higher operating frequencies, where the only limit is equipment size. An American derivative of the Cranfield design and the Simms version of ultrasonic atomizers has been successfully tested.

2671 APTIC NUMBER 20735

Moser, Charles E.
AUTOMOTIVE EMISSION RESEARCH. Chem. Eng., 77(9):221-226, April 27, 1970.

Advances in the reduction of automotive air pollution since 1962 are reviewed and current and proposed programs concerning automotive emission suppression are discussed. Fuels are considered in terms of their vapor pressure, olefin content, and the effects of their lead content as an atmospheric pollutant. Engine modification programs discussed included catalytic reactors to render exhaust fumes innocuous, thermal reactors for additional combustion, and fuel evaporation recovery systems to prevent the escape of smog-forming hydrocarbons into the atmosphere. Principle emphasis is on the current and proposed studies to accurately define the problem in terms of realistic driving cycles, types and amounts of pollutants released into the atmosphere, chemical and physical factors involved in the build-up and dispersion of pollutants once they reach the atmosphere, and the relationship between the physical and chemical properties of pollutants. Also discussed are engineering studies for the development of improved instrumentation and corresponding measurement techniques to precisely identify individual pollutants and reactions among them.

2672 APTIC NUMBER 21546

Moscoe, W. E., J. W. Crossett, and T. N. Armstrong
STEELS FOR THE CONTAINMENT OF LIQUEFIED GAS CARGOES. Trans. Soc. Naval Architects Marine Engrs., vol. 67:423-448, 1959. 9 refs. (Presented at the Society of Naval Architects and Marine Engineers Annual Meeting, New York, Nov. 12-13, 1959.)

Naval architects are being called upon to design ships which will transport liquefied gases at near atmospheric pressures and sub zero temperatures safely and economically. The configurations and service conditions aboard ship are undoubtedly more restrictive than those encountered with land-based containers, but the experience obtained over many years of successful service in this field of low-temperature liquid handling may serve as a guide for the selection of materials for marine transporation. Arbitrary limits as to the lowest service temperature of the various nickel steels have been established. The engineering properties of steel that are important to low-temperature use are discussed. Design data sheets are presented for the various nickel steels and for stainless steel. Included are standard specifications and their requirements, pressure-vessel design stresses, fatigue properties, and test results on low-temperature notch-toughness. Data on thermal expansion, conductivity and specific heat are also presented. The results of fracture tests on cylindrical welded prototype tanks of nickel and stainless steel filled with liquid nitrogen are discussed. Proposed tests to demonstrate further the suitability of nickel steel for use in tanks to contain cryogenics are discussed. (Author abstract modified)

2673 APTIC NUMBER 21434

Moyer, Ralph H. and Grady E. Taylor
ACOUSTIC AND PURIFYING EXHAUST MUFFLER. (Assignee not given.) U. S. Pat. 3,477,826. 3p., Nov. 11, 1969. 7 refs. (Appl. Jan. 28, 1966, 8 claims).

An improved acoustic and purifying exhaust muffler assembly is described of the side entry type which includes an auxiliary chamber for removing most of the objectionable particles from the exhaust, with a back pressure relief system for preventing the reentry of exhaust fumes and particles into the internal combustion engine. Its filters need only be changed every 4,000-6,000 miles of vehicle operation. The assembly comprises a primary, acoustic muffler chamber, including an elongated shell with intake and exhaust ports and a removable, central core with a plurality of filter elements which also serve as baffles to abate engine noise. A secondary, auxiliary muffler chamber is mounted parallel on one side of the primary chamber, and includes an entry port communicating with the primary chamber, an exhaust outlet, and an internal filter packing for absorbing exhaust gases and materials. A relief line is mounted adjacent the entry port of the auxiliary chamber, and also communicates with the primary chamber to vent the exhaust line of the engine and thus prevent back pressure from forming.

2674 APTIC NUMBER 21295

Mueller-Berner, A. H. and P. Striffler
ELECTRIC BUS WITH HYBRID DRIVE FOR CITY TRAFFIC. (Elektrobus mit Hybridantrieb fuer den Stadtverkehr). Text in German. Automobiltech. Z. (Stuttgart), 72(3):78-84, March 1970. 6 refs.

Electric buses should be able to attain a maximum speed of 70 km/hr; they should be able to accelerate 1 m/sec sq to a speed of 20 km/hr; and they should be able to climb steep grades (10%). Lead storage batteries alone are not sufficient to meet the requirements, but they can be met if the bus features hybrid drive with greatly diminished battery size and a diesel engine driven charger, as well as electronic pulse control. An electric test bus is described which has a direct current driving motor with pulse control. The energy is stored in 2 to 3.5-ton-armour plate lead batteries. The power generator consists of a diesel engine with 60 to 80 HP and an ac generator. Although this bus will be able to transport less passengers, it produces no exhaust gases, makes little noise, is comfortable, and simple to operate.

2675 APTIC NUMBER 21296

Mueller, P.
DECONTAMINATION OF EXHAUSTS FROM OTTO ENGINES THROUGH CONSTRUCTIVE MEASURES AT CARBURETOR AND IGNITION SYSTEM. (Entgiftung der Abgase von Ottomotoren durch konstruktive Massnahmen an Vergaser und Zuendanlage). Text in German. Technik (Berlin), 25(1):35-40, Jan. 1970. 4 refs. (Presented at a Symposium on 'Toxicity of Combustion Engines and Ways of Reducing It.', Moscow, Dec. 6-10, 1966.)

Combustion with excess air is imperative for low carbon monoxide concentrations in the exhaust of Otto engines. This poses, however, the problems of distributing equal fuel/air quantities to the cylinders. Experiments on a four-cylinder four-stroke Otto engine demonstrated the great influence of the symmetric construction of the carburetor on a satisfactory distribution of the fuel/air mixture. Through air and fuel quantity measurements, the total to air ratio, was determined. The exhausts sampled behind each cylinder were examined with an Orsat analyzer. Two cylinders received a rich mixture and two, a lean mixture. The reason for this was found in the 45 degree angle formed by the entering injection tube and by the axial throttle plate play. The injection tube was realigned so that it entered perpendicularly to the throttle and the throttle was fixed exactly in the center. As a result, the air to fuel ratio varied only very little from cylinder to cylinder. To avoid high CO-fractions in the exhaust when the brakes are applied, the underpressure in the intake pipe must be avoided and any fuel flow must be blocked in the idle. Experiments in the ignition system of a six-cylinder four-stoke engine at constant 3000 rpm revealed that for lean mixtures, large electrode intervals and long burning sparks are of advantage.

2676 APTIC NUMBER 20602

Mueller, Herbert
ENGINE MODIFICATIONS TO IMPROVE THE COMPOSITION OF EXHAUST GASES. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(6):1-10, June 1969. 8 refs.

The energy conversion of the fuel-air mixture is considered with respect to influencing the exhaust gas composition. The

composition of exhaust gas from an actual engine is compared with that from an engine with uniform mixing conditions. In the case of an Otto engine, the effect of the wide-boiling range of fuel has a considerable influence and, consequently, the distribution of fuel to the individual cylinders is nonuniform in a multicylinder engine. Investigations of cyclic variations in pressure development indicate that mixing in the combustion chamber of the Otto engine is inhomogeneous. The intended layer charging does not improve the exhaust gas composition for the engine. (Author summary modified)

2677 APTIC NUMBER 21200

Mueller-Wartenberg, Heinz
APPARATUS FOR CARRYING OUT A METHOD OF PURIFICATION FOR FLUE GASES. (Metallgesellschaft A. G., Frankfurt (W. Germany))
U. S. Pat. 3,475,133. 14p., Oct. 28, 1969. 6 refs. (Appl. Dec. 30, 1965, 9 claims).

An apparatus is proposed for a multi-stage method of purifying flue gases which contain sulfur compounds, particularly the flue gases of oil- or coal-fired boilers. After the gases have been previously treated in coolers and scrubbers and had the dust removed from them in mechanical or electrical dust precipitators, they are subjected to a wet catalysis with coal or carbon as the catalyst in order to remove the sulfur-containing compounds, particularly sulfur dioxide. The cooler and/or scrubber, and, if employed, the dust precipitator are arranged vertically one above the other with catalyst reaction beds in a tower-like common housing of prefabricated plates forming a closed gas shaft. The gas shaft is divided up vertically into a series of flues by a series of superimposed catalytic reaction beds and run-off trays which form barrier walls. The reaction beds are staggered vertically in a staircase-like manner so that they are shifted with increasing length into the oncoming flow of gas. The lateral offset provides an upwardly decreasing flow area on the inlet side of the beds and an upward increasing cross-sectional flow area on the outlet side of the beds. The lower part of the gas shaft forms an acid or fluid collecting container.

2678 APTIC NUMBER 21478

Muhlbauer, H. G. and P. P. Monaghan
NEW EQUILIBRIUM DATA ON SWEETENING NATURAL GAS WITH ETHANOLAMINE SOLUTIONS. Oil Gas J., 55(17):139-145, April 29, 1957. 12 refs. (Presented at the Gas Conditioning Conference, Norman, Okla., March 6, 1957.)

A study was performed to completely define the system hydrogen sulfide-carbon dioxide- 2.5 N aqueous monoethanolamine at 25 C and 100 C and at hydrogen sulfide and carbon dioxide partial pressures in the region of 1 to 700 mm Hg. The equilibrium data obtained are presented both tabularly and graphically. The purpose of the study was to develop data which could be used in the accurate design of systems for the removal of acid gases from natural gas by their adsorption in ethanolamine solutions. Though the data obtained is not applied to any design solutions, some guidelines and simplifying assumptions to be used in the application of the data are included.

2679 APTIC NUMBER 21551

Nachshen, Maurice
BELOW-GROUND CONTAINERS FOR LIQUID NATURAL GAS. Consulting Eng., 39(6):68-70, June 1966.

The safety, design, and construction aspects of cryogenic in-ground containers for liquefied natural gas are discussed. Such tanks are basically large ground excavations with an insulated metal roof over the top; prior to excavation, the surrounding area is frozen by circulating a freezing medium (such as liquid propane) through pipes installed in holes drilled for this purpose. Frozen soil has useful structural properties, for example a high compressive stress, and once frozen, it is maintained in this condition by the presence of the LNG in the container. Spillage is impossible and the tank is considered safe even from an earthquake. Soil and geological conditions of the site govern the ratio of depth to diameter; ideally, the least surface area for a given volume is the most desirable. Timing of the construction work is important, and requires careful consideration of the permeability patterns which will occur between the completion of excavation and the establishment of a frozen bottom plug when the container is in operation. It is costly to pre-freeze the container floor and it is normal to rely on the unfrozen strength of the soil contained in the lower extremities of the frozen soil walls to resist the large hydrostatic upthrust acting on the floor of the container. The container roof must satisfy the requirements of insulation and gas-tightness that must be maintained when the roof is subjected to thermal movements or other stress.

2680 APTIC NUMBER 20492

Naeve, K. L.
OPERATING EXPERIENCES OF A SMALL LNG PLANT. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 10p. 5 refs. (April 7-12, Session no. 2, Paper 8.)

Wisconsin Natural Gas Company owns and operates a liquefied natural gas (LNG) plant for peak shaving purposes, the main components of which are a 72,000 barrel capacity double wall tank, a cascade refrigeration system with a capacity of approximately 1,000,000 cubic feet per day, and facilities to revaporize 25,000,000 feet per day with 100 per cent standby. Operating problems were experienced with the molecular sieves due to insufficient flow of regeneration gases, but sieve material and the regenerator heater were replaced and operation has increased 50% in adsorption capacity. Modifications were made also in the control and alarm system of the liquefaction cycle through the relocation of valves and minor changes on compressors to provide greater reliability of standby compressor capacity for tank boiloff.

2681 APTIC NUMBER 21172

TRIS NEW GAS LIQUEFYING METHOD USED IN CLEVELAND. Natl. Underwriter, vol. 49:15-16, Feb. 15, 1945.

A cascade system for liquefying 4 million cu ft of natural gas per day is described. Gas entering the plant is first compressed to 600 lbs gauge, after which it is passed through an ammonia scrubbing plant to remove water and carbon dioxide, and then to ethylene exchangers. In the ethylene circuit, the gas is reduced to a liquid and chilled to -126 F. After further chilling in two flash gas exchangers to -139 F, the gas is cracked into a first expansion tank at a pressure of 55 lbs gauge. About half the liquid is retained and the remainder sent back to be recompressed. The liquid from the tank is cracked directly into the main double-walled storage tanks.

2682 APTIC NUMBER 21476

Nelson, A. B.
NEW CRYOGENIC STORAGE SYSTEMS. Pipe Line Ind., 29(4):75-80, Oct. 1968.

Conventional and developmental insulation materials and techniques are evaluated for their applicability to the storage of liquefied natural gas. Perlite, though inexpensive and easy to apply, compacts readily as a result of thermal working of the tanks and can generate compression loads sufficient to buckle the inner tank wall. Two new insulation techniques recently developed to overcome this adverse effect are an all glass fiber insulation system and glass fiber used in conjuction with perlite. The latter system has a glass fiber blanket around the exterior of the inner tank and another covering the interior of the outer tank. Tank motion is isolated from the perlite by the flexing glass fiber blanket, thereby reducing perlite compression. The former method, used in a 175,000 barrel capacity tank under construction at Siezia, Italy, used a crosslapped pattern of glass fiber bundles in the annular space to reduce heat leaks. Heat leak has been reduced to 0.0362 %/day using the all glass fiber method.

2683 APTIC NUMBER 20136

Nelson, Ralph H. and William G. Nostrand
AIR FILTER WITH SECONDARY SAFETY FILTERING ELEMENT. (Nelco Filter Corp., Stoughton, Wis.) U. S. Pat. 3,494,114. 4p., Feb. 10, 1970. 9 refs. (Appl. Dec. 14, 1967, 2 claims).

A passageway is provided around the working filter element whereby a controlled proportion of the air entering the filter unit is permitted to bypass the working element and flow directly to and through the safety filter element. The dirt-holding capacity of the working filter element is consequently increased, as is the time interval between replacements of the working element. This is accomplished very simply by providing small apertures at appropriate locations in walls of the filter apparatus.

2684 APTIC NUMBER 20681

Nelson, W. I.
NATURAL GAS LIQUEFACTION. Brit. Chem. Eng., 13(4):509-511, April 1968. 3 refs.

Three approaches to natural gas liquefaction are reviewed: standard cascade cycles; expander cycles; and ARC (Auto Refrigerated Cascade) cycles. Typical flow diagrams for each of these techniques are presented and discussed. The ARC cycle has a lower investment cost as compared to the standard cascade, but this is balanced against a higher power requirement.

2685 APTIC NUMBER 20414

Newman, Daniel J. and Jorge M. Matta
APPARATUS FOR NITROGEN OXIDES ABSORPTION TO PRODUCE CONCENTRATED NITRIC ACID. (Chemical Construction Corp., New York, N. Y.) U. S. Pat 3,649,744. 7p., March 10, 1970. 4 refs. (Appl. Jan. 5, 1967, 10 claims).

An apparatus is provided for the absorption of nitrogen oxides from a gas stream into an aqueous absorbent solution to form nitric acid, in which re-oxidation of nitric oxide also takes place. The apparatus is provided with a lower combination heat exchanger-absorber section in which the simultaneous absorption of nitrogen dioxide, re-oxidation of nitric oxide, and cooling of the liquid phase takes place. Two or more heat exchanger sections may be provided in series. A gas-liquid contact section such as a packed section or a plurality of perforated trays is provided above the heat exchanger sections. The feed gas stream containing nitrogen oxides and excess free oxygen is passed into the apparatus below the heat exchanger sections, while the aqueous absorbent solution is admitted above the upper gas-liquid contact section. (Author abstract)

2686 APTIC NUMBER 20749

Nicolin, Thomas and Frederick Farrington
TREATMENT OF HYDROCARBONS AND CATALYSTS THEREFOR. (Assignee not given.) U. S. Pat. 3,475,328. 5p., Oct. 28, 1969. 7 refs. (Appl. June 19, 1967, 9 claims).

The conventional method of removing organic sulfur compounds from hydrocarbons is either by acid washing, particularly where the sulfur content is very high, or reduction of the sulfur compounds to hydrogen sulfide by hydrogen in the presence of a catalyst. Both processes are expensive. In accordance with the present invention, sulfur compounds, including carbon disulfide, are removed from hydrocarbons in the vapor phase when heated with steam at elevated temperatures in the presence of uranous-uranic acid and/or uranium trioxide supported on an inert carrier such as aluminum oxide. The reaction temperature is usually between 450-500 C; the pressure is atmospheric or higher. The catalyst is formed in the reaction space by introducing a catalyst precursor and thereafter converting the precursor to the active catalyst.

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2687 APTIC NUMBER 20612

Nielsen, Richard W. and Harry M. Meyer
PERFORMANCE OF A 48-MODULE SWIRL-CAN TURBOJET COMBUSTOR SEGMENT AT HIGH TEMPERATURES USING ASTM-A1 FUEL. National Aeronautics and Space Administration, Washington, D. C., TN D-5597, 39p., Dec. 1969. 9 refs.

The performance of a turbojet engine combustor composed of 48 swirl-can modules, each consisting of an inlet section serving as a carburetor followed by a swirler and a divergent conical combustor can was investigated. In operation, primary combustion air enters the carburetor and mixes with fuel. The fuel-air mixture passes through the swirler and burns in the combustor can. Secondary combustion air flows axially past the swirl-can module, recirculates in the wake, and completes the combustion reaction. Smoke formation is reduced by the pre-mixing of fuel and air and by the abundance of air available at all stages of the burning process. Combustion tests with liquid fuel were conducted at air inlet temperatures of 600 and 1150 F, 1 atm, and reference velocities up to 180 ft/sec (54.9 m/sec). Combustion efficiencies were 100% at exit temperatures near 2200 F. Overall pressure loss was 6% at a diffuser inlet Mach number of 0.25 and an exit- to inlet-temperature ratio of 2.5. The exit temperature pattern factor varied from 0.19 to 0.24, decreasing with increasing inlet temperature. Altitude blowout and relight tests showed that combustion was stable and ignition could be achieved at inlet air temperatures of 600 and 700 F and with pressures as low as 0.5 atm. No measurable traces of smoke were found in combustor exit gases when pressure was 1 atm, inlet temperatures 150 to 600 F, and at fuel-to-air ratios of 0.015, 0.020, and 0.022.

2688 APTIC NUMBER 21709

Niesage, S.
THE POSSIBILITIES OF REDUCING THE EMISSIONS OF DOMESTIC HEATING THROUGH THE USE OF REMOTE HEATING SYSTEMS, GAS HEAT, ELECTRIC HEAT. (Moeglichkeiten der Emissionsverminderung im Haushalt durch Einsatz von Fernwaerme, Gaswaerme, Elektrowaerme). Text in German. VDI (Ver. Deut. Ingr.) Ber., no. 149:117-122, 1970. 6 refs.

All solid non-prepared fuels used for domestic heating must be considered as medium to heavy air polluters. Fuel oil causes negligible dust emissions but considerable sulfur dioxide emissions. Remotely supplied heat, gas heat, and electric heat cause no emissions at least at the point of consumption. Remote heating plants and power plants are equipped with efficient gas cleaning systems which reduce dust for example, to 20%. Nevertheless, it is foreseen that remote heating will hold its present 2% fraction, while electric heat will increase in use from 10 to 13% over the next three decades, and gas heat will move up from 7% to 10%. The observed reduction of dust emissions by domestic heaters from a peak in the early 1960's back to the level of 1950 is mainly due to the use of prepared fuels and the increased use of fuel oil. The latter however, increased the sulfur dioxide emissions.

2689 APTIC NUMBER 20745

Nilsson, Karl Folke
BAG FILTER SYSTEM. (Svenska Aktiebolaget, Stockholm, Sweden) U. S. Pat. 3,486,310. 3p., Dec. 30, 1969. 9 refs. (Appl. June 3, 1968, 4 claims).

A bag filter system which includes a number of bag or hose-like filters mounted in an upright housing is described. The walls of the filter bags segregate a space for impure g and a space for filtered gas. A stand is provided which sup rts the filters and which can be rotated in relation to the filter housing. Each filter can thus appear in the area of an opening in the housing to enable them to be reached from outside the housing. (Author abstract modified)

2690 APTIC NUMBER 20981

Nivsgi, P. K., D. Vaidya, P. Duhaut, and M. G. Krishna
IMPROVEMENT OF SMOKE POINT WITH HYDROGENATION. Chem. Age India, 21(1):151-154, Jan. 1970. 11 refs.

Investigations were undertaken to determine the extent to which aromatic compounds in paraffinic and naphthenic base kerosenes depress the smoke points of the kerosenes and the degree to which hydrogenation of the kerosenes improve smoke point. The depressing influence of aromatics in both paraffinic and naphthenic base kerosenes was in the following increasing order: C10, mixed alkyl benzenes, tetralin, naphthalene, alpha-methyl naphthalene, diphenyl; i.e., in the order of more compactness of the molecule or its increased carbon content. The major part of the depression produced by a given aromatic compound on smoke points was observed at aromatic concentrations within 30%. During hydrogenation of the kerosenes, an initial improvement in smoke point was effected by the preferential conversion of diaromatics to hydroaromatics. Further improvements were dependent on the extent of reduction in aromatic content due to hydrogenation. Smoke improvement of gasoline fractions at various depths of hydrogenation can be predicted if initial smoke point and volume percent aromatics are known, by plotting smoke against unit change in aromatic content. The correlation between the two factors is within one unit up to the 50 to 60 level and within two units above.

2691 APTIC NUMBER 20651

O'Neill, James D.
EXHAUST EMISSION REDUCING ADDITIVE. (Ethyl Corp., New York) U. S. Pat. 3,488,217. 4p., Dec. 16, 1969. 5 refs. (Appl. Oct. 17, 1966, 7 claims).

A liquid hydrocarbon fuel containing a benzylidene bisphenol is described as reducing hydrocarbon emission in the exhaust gas of an internal combustion engine and also reducing the amount of

combustion chamber deposits. Benzylidene bisphenols are readily made by the reaction of the appropriate phenol with a carbonyl compound in a solvent using an acid or base catalyst, and the most preferred benzylidene bisphenol is 4,4'-benzylidene bis(2,6-di-tert-butylphenol). If the amount of unburned hydrocarbons initially in the exhaust can be reduced, the need for secondary oxidation is diminished.

APTIC NUMBER 21275

2692

Oda, Kenichi and Yoshimi Ishihara
METHOD FOR REMOVING SULFUR DIOXIDE FROM FLUE GASES OF A COMBUSTION FURNACE. (Electric Power Industry, Tokyo (Japan), Central Research Inst.) U. S. Pat. 4,481,289. 4p., Dec. 2, 1969. 2 refs. (Appl. May 13, 1968, 5 claims).

A method for removing sulfur dioxide from the flue gases of a fuel oil or coal fired furnace is described. An hydroxide, converted from an oxide in discharge calcined limestone or dolomite, is injected into the furnace. A newly prepared powder of limestone or dolomite is also injected. Although the calcined product discharged from the furnace contains sulfates, the main component is calcium oxide. When water is added to convert the oxide to hydroxide, the hydroxide formed has a high reactivity and removes SO2 very effectively. The reactivity of the hydroxide can be improved by using an iron salt solution as the hydration water. Previous proposals to remove SO2 from flue gases by injecting pulverized limestone or dolomite powder into a furnace have the advantage of being inexpensive and simple, but the disadvantage that the rate of SO2 removal is low.

APTIC NUMBER 20628

2693

Odaira, T., J. Fazumi, F. Koyama, and T. Ishiguro
CONTROL ON ODOR OF FISH MEAL PLANTS IN DRYER EXHAUST. (Gyochokotsu shori kojo no kansoki haikigasu dasshushori ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):72, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Among the nuisance complaints to the Tokyo Metropolitan Government, 20% concern obnoxious odors. One of the main sources is considered to be the fish meal plants. A study was conducted on how odors can be removed within the existing production framework. The main sources are the exhausts from the dryers and the liquids produced by pressing fish parts. Limiting the scope to exhausts, the following control methods were tested: ozone oxidation, chemical purification, and absorption; the block diagram for each process is presented. The tabulated results show that each control method, the rate of odor removal was 60 -80%. Although the percentage is tolerable for ordinary dust particles, it is not enough for bad odors and further improvement is necessary.

APTIC NUMBER 21019

2694

Ogawa, A., M. Kurose, and F. Ikemori
COLLECTION CHARACTERISTICS OF THE CYCLONES IN SERIES. (Chokuretsu cyclone no hoshutokusei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):80, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Carbon black particles 0.3 micron in size were fed into three cyclones of the same size connected in series, and the relationship between eta the rate of capture (%)) and the wind velocity at entrance (meters per sec) as well as the rate of penetration (%) versus the initial concentration (grams per cubic meter) were investigated. The rate of capture eta of the cyclone is a decreasing exponential function, depending on the wind velocity at entrance. The eta for the individual cyclone reached a maximum at the velocity of 7-8 m/sec, apparently because the coalescence of dust particles becomes overshadowed by the dispersion effect beyond that range.

APTIC NUMBER 20910

2695

Ohtsuka, Tadao, Yoshikazu Hasegawa, Michio Koizumi, and Tassio Ono
HYDRODESULFURIZATION OF KHAFJI CRUDE OIL. Bull. Japan Petrol. Inst., vol. 9:1-6, March 1967. 5 refs.

Khafji crude oil, which contains 2.78% sulfur, was hydrodesulfurized, using a conventional cobalt-molybdate catalyst under a constant hydrogen pressure of 40 kg/sq cm G. Approximately four moles of hydrogen were required to remove 1 mole of sulfur from the petroleum, in order to obtain sulfur removal between 30% and 60%. Six moles of hydrogen were required for 80% removal. For 50% removal, the hydrogen consumption amounted to about 40 cu m per kiloliter of petroleum. In mild processing, the vanadium content of the oil did not decrease, but the asphaltene content decreased in direct proportion to the amount of sulfur removed. The sulfur removal process was apparently a second-order reaction. (Author summary modified)

APTIC NUMBER 21531

2696

CAMEL ESTABLISHES ROUTINE OPERATIONS AT ITS ARZEW PLANT. Oil Gas J., 66(19):99-100, April 29, 1968.

The problems involved in the start-up and operation of a natural gas liquefaction plant are described with specific examples drawn from those experienced at a plant in Arzew, Algeria. Equipment breakdown, process debugging, and in this case, even a war combined to delay the attainment of routine operations. Some of the process simplifications that were instituted to eliminate systems generating excessive maintenance costs are described.

APTIC NUMBER 21591

2697

HOLE IN THE GROUND STORES FRIGID LNG. Oil Gas J., vol. 59:60-61, Oct. 16, 1961.

A prototype facility is described which demonstrates the feasibility of frozen-earth storage of liquefied natural gas. The storage facility is an unlined, aluminum-capped pit with a capacity of 850 bbl. Its construction was begun by drilling 80-ft deep holes in a 28-ft circle. These were used for freeze pipes which circulated the refrigerant to freeze the soil. Excavation began when the frost boundary layer moved inward 4 ft, leaving a 20-ft unfrozen circle in the center. After installation of the insulated roof, the walls of the hole were sprayed with liquid methane to further cool them and to prevent thermal shock. The pit has proved to be an adequate barrier for containing -258 F liquid. An advantage of the frozen-earth technique is that no diking is required, thus permitting pits to be spaced more closely than is possible with aboveground tanks.

2698 APTIC NUMBER 21544

LIQUEFACTION, STORAGE UNIT PLANNED IN BROOKLYN. Oil Gas J., vol. 63:97, Sept. 27, 1965.

A liquefaction plant and storage facility for liquid natural gas is planned for Brooklyn. The plant will be used for peak-shaving, since the winter demand is growing at a faster pace than supply can handle. The plant will be more economical than underground storage since it will eliminate the pipeline cost of sending gas to and from the storage fields. The liquid will be stored in a double-walled tank. Cooling is accomplished by an expander refrigeration system.

2699 APTIC NUMBER 21562

LIQUEFACTION PLANT TO USE NEW METHOD. Oil Gas J., vol. 62:26-27, June 29, 1964.

The first major liquefied natural gas peak-shaving plant on the west coast will use the expansion cycle technique to liquefy methane for storage. Incoming gas with a line pressure of 300 psia will be stripped of water, carbon dioxide, and hydrogen sulfide and cooled in a heat exchanger to minus 140 F at constant pressure. The saturated vapor will then be sent to an expander turbine which will drop the pressure to 50 psi and the temperature to minus 250 F. The condensed methane will be stored in a double walled, above ground storage tank for use during peak demand periods.

2700 APTIC NUMBER 21563

LIQUEFIED GAS TANKER CAPACITY SOARING. Oil Gas J., 66(8):87, Feb. 19, 1968.

Worldwide capacity for sea transport of liquefied natural gas is increasing rapidly. Not only is the number of vessels growing, but also the capacity per vessel. Most new ships are either fully regrigerated at atmospheric pressure or semirefrigerated; a few are full-pressure vessels. The Norwegians are doing 30% of the construction of new vessels in 1968. Several very large ocean-going projects are likely to start between 1970 and 1975. Transported quantities and major ports of ammonia, ethylene, and LP-gas during 1967 are discussed.

2701 APTIC NUMBER 21564

LNG PIT WILL SOON GET CHILLY TREATMENT. Oil Gas J., 63(34):68-66, Aug. 24, 1966.

A natural gas liquefaction plant in New Jersey will employ a cascade system which uses propane and ethylene as refrigerants; auto-refrigeration will be utilized in which the temperature of the incoming feed gas is lowered successively by heat exchange with the coolants, and with the cold flash and boiloff gases from the storage container. The frozen inground storage facility is a cylindrical cavity 115 ft in diameter and extending 165 ft below the surface. The cavity is insulated and topped with a 9% nickel steel roof. Actual gas-storage operations depend on how long it will take to cool down the earthen storage pit. Plans call for gradually freezing the earth to rock-like hardness for a distance of 30-40 ft around the rim of the pit. A ring of vertical freeze pipes installed in the earth has already been used to freeze it down to the hard shale. The controlled adeission of LNG at -259 F will lower the temperature of the entire cavity and the surrounding area. When filled, the storage will hold 1 billion cu ft of natural gas in liquid form; it will have a delivery capacity of 200,000 Mcfd and a liquefaction rate of 5000 Mcfd.

2702 APTIC NUMBER 21556

NEW LNG PILOT PLANT IS OPERATING. Oil Gas J., 63(17):110-111, April 26, 1965.

A recently completed pilot plant for natural gas liquefaction incorporates many of the latest techniques found in comsercial plants. Included are provisions for extracting heavy and light ends from natural gas and a system for removing carbon dioxide and other undesirable components from the product. The facility, which uses a cascade cycle, can be transported to any location for demonstrations or to liquefy any desired natural gas available. Another purpose of the plant is to provide information for designing and improving full-scale liquefaction plants. Provisions have been made for collecting pressure, temperature, and flow data for storage on computer programs.

2703 APTIC NUMBER 21561

NEW LNG PLANT MAY CLEAR WAY FOR OTHER PROJECTS BEING CONSIDERED. Oil Gas J., vol. 62:48-89, March 9, 1964.

A leading cryogenics company is joining forces with a gas distributor for the construction and operation of an LNG plant. The cryogenics company will own and operate the liquefaction section; the gas distributor will own and operate the storage and revaporization sections and retain title to the gas. This

formula offers an attractive investment possibility to the cryogenic company in a field allied with its main business and permits the gas distributor to invest a greater proportion of his capital in expanded facilities. Gas will be liquefied in a propane- ethylene cascade cycle. Storage will be in double wall above-ground tanks. The liquid methane will be regasified during peak demand periods, supplementing existing propane-air plants.

2704 APTIC NUMBER 21573

NEW LNG PEAK-SHAVING PLAN PROPOSED. Oil Gas J., vol. 62:48-49, March 30, 1964.

Long-distance water movement of liquefied natural gas is planned for a liquefaction facility to be constructed on the East Coast. By moving liquid gas in barges from the plant to storage tanks in port areas along the coast, it is expected that peaking requirements can be met at a lower cost than by increasing pipeline capacity. The plant will be capable of liquefying 15 billion cu ft of gas per year and will have an adjacent LNG storage of 1.5 to 2 billion cu ft. The cost of the plant, attendant storage, and barges is estimated at $29 million. Another $71 million will go into consumer storage and related facilities.

2705 APTIC NUMBER 21560

NEW LNG STORAGE PLAN MAY CUT COSTS. Oil Gas J., vol. 59: 50, 52, Dec. 18, 1961.

A demonstration of the ability of an underground pre-stressed concrete storage tank for liquid natural gas (LNG) is being undertaken in Chicago. If this storage demonstration is successful, the overall investment of a liquefaction plant may be cut by 25%. The test is sponsored by the gas industry and by other industries with an interest in LNG. Prospects for national and international LNG projects are reviewed. LNG is conceived as a base-load supply of fuel in high energy-cost areas outside the U. S. Application in the U. S. seems confined to peak-shaving using pipeline gas.

2706 APTIC NUMBER 21526

TEXAS EASTERN UNVEILS LNG TANK PLAN. Oil Gas J., 63(37):64-65, Sept. 13, 1965.

The design of a new circular storage tank for liquefied natural gas has at least three main features not incorporated in other tanks now in operation or under construction. The first is that pre-stressed concrete forms the walls and base of the tank. Above the liquid level is a vapor space formed of a self-supporting metal or concrete dome. The second unique feature is that the tank stands partly underground and partly above, but after construction has a sloped earth-fill rising to near the top. Finally, the storage system includes a recirculation of the boiloff gas to convert it back to liquid and return it to the tank. Under the recirculation plan, the boiloff gas collects in the dome and then starts its movement through the liquefaction train with two centrifugal compressors. It passes through a cold box and a series of heat exchangers where the temperature drops to the liquefying level. The facility will be able to move 200 MMcfd.

2707 APTIC NUMBER 21484

TRANSCO CHOOSES INGROUND STORAGE FOR BIG LNG. Oil Gas J., vol. 61:70-71, Feb. 25, 1965.

A brief description is given of the inground cryogenic liquefied natural gas storage facility planned for construction in the New Jersey Meadows west of New York City. The tank will store the liquid equivalent of one billion cu ft of natural gas and will have a delivery capability of 200 million cfd for five days, in its function as a peak shaving facility. Safety in a heavily populated area was a major factor in choosing this type of storage. Charges to the seven local upstream gas companies that will purchase the gas will consist of a separate rate for demand, capacity, and delivery.

2708 APTIC NUMBER 21576

TRANSPORTATION, STORAGE FOR GROWING GAS SUPPLIES STRESSED. Oil Gas J., 65(16):186-187, 190-191, April 17, 1967.

The continuing demand for natural gas from overseas sources calls for increasingly larger ships for ocean transport of liquefied natural gas (LNG). Simultaneously, there is a growing need for competitive methods of storing LNG for peak shaving demands. The underground cavern may prove to be a more economical storage method than aboveground concrete tanks or in-ground cryogenic storage vessels. Since LNG is stored at atmospheric pressure, a cavern need not be as deep as for LP-gas storage. A feasible mining technique is a large, inclined entry to a room-and-pillar cavern. Excavating cost per barrel of storage for the inclined entry method is estimated at about $1.82 as compared to $4.31 for a vertical-shaft entry. Total cavern cost, estimated at $1,571,100 for a 300,000-bbl pilot cavern, must also take into account sealing, erection of bulkheads, and a liner-insulation system system designed to reduce heat-influx rates from bare rock. Flexible metal-plastic panels fastened to foamed urethane panels are suggested. Ships with membrane tanks having up to 50 times the capacity of 'free-standing' tanks having up to 50 times the capacity of 'free-standing' tanks are now under consideration for ocean transport of LNG. The membranes must be able to accommodate movement due to both thermal expansion and contract and also pressure variations. Invar and stainless steel are practical materials. In membrane designs, special insulation systems must also be provided to support the full weight of the cargo.

2709 APTIC NUMBER 21571

U. S. GROUP PLANS VENEZUELAN LNG PLANT. Oil Gas J., 63(51):38, Dec. 20, 1965.

A new type of ship under consideration for transporting liquefied natural gas from Venezuela to Europe and perhaps the U. S. east coast will have an integrated tank design, the hull of the ship serving as the outer shell of the tank. The tank will be constructed of thin-wall, flexible metal sheets with no integral strength of their own but with a pattern of corrugations that will accommodate extreme temperature changes. The sheets will be bonded to the hull in such a way that the hydrostatic and hydrodynamic pressures of the LNG are transmitted to the structure of the vessel. The imported LNG will be used for peak-shaving purposes. Economic disadvantages which limit LNG to being primarily a premium secondary energy source are noted.

2710 APTIC NUMBER 21480

WORK DRAGS ON UNIQUE RESERVOIR. Oil Gas J., vol. 62:101, Oct. 5, 1964.

Note is made of delays in constructing the first in-ground cryogenic liquefied natural gas storage facility, being built in the New Jersey meadows just west of New York City. When completed, the container will have a storage capacity of 1 billion cu ft of natural gas in liquid form, and a gasification capacity of 200 million cf/d. The delivered cost of the gas is expected to average about $2.20/Mcf.

2711 APTIC NUMBER 21505

Oraston, Robert H.
LIQUEFACTION: THE ANSWER TO STORAGE?. Gas Age, vol. 113-114:27-33, Feb. 25, 1954. 16 refs.

The process of liquefaction of natural gas is defined, and the development of the industry is reviewed. A history of the 'Cleveland tragedy' and a description of that plants' equipment is included. The advantages of a liquefaction plant are summarized. Various types of storage facilities are discussed, with particular emphasis on the type the Cleveland installation employed. Metallurgical factors affecting the behavior of ferrous metals at low temperatures, including notch toughness, are described.

2712 APTIC NUMBER 20852

Owens, D. F. and A. T. Bossano
DESIGN PROCEDURES TO CONTROL CIGARETTE SMOKE AND OTHER AIR POLLUTANTS. ASHRAE Trans., (Am. Soc. Heating, Refrig. Aircond. Engrs.). 75(1):93-102, Jan. 1969. 26 refs. (Presented at the ASHRAE Semiannual Meeting, Chicago, Ill. Jan. 27-30, 1969, Paper 2297.)

A design procedure for the air supply in an air conditioning system will include a determination of the amount of outside air that is desired. From data provided by the air-pollution control agencies, the amounts of gaseous and particulate pollutants can be obtained. Depending on the cleanness of air desired, filters can be selected that will remove the undesirable constitutents. Recirculating air is desirable in many areas, as it reduces the energy requirements for cooling outside air. Pollutants that will be encountered in recirculated air in the usual meeting place will be from cigarette smoking and body emanations. Pertinent data is provided and its use is illustrated in analyzing the air cleaning requirements. Very detailed compositions of smoke emitted by the smoker of a cigarette without a filter, with an acetate filter, or with a combined acetate adsorbent filter are given. To utilize these data, it is necessary to know how many puffs of what size are taken at what time intervals by an 'average' smoker to consume a cigarette of a given size, as well as the number of such smokers in a given meeting place. Amounts of gases given off by the adult male human body per 24 hours are listed. Typical outdoor air pollution data for 1965 for Chicago are also given together with formula for the change of concentration of a given constitutent in air under any given regime of recirculating the air under admission of outside air.

2713 APTIC NUMBER 21538

Owens, Stanley
UNIQUE PROTECTION SYSTEM FOR FROZEN GAS STORAGE. Pipeline Eng., vol. 38:56-57, 60-62, April 1966.

A dry chemical fire-fighting system was built to protect an in-ground liquefied natural gas storage tank in Carlstadt, N. J., from fire. An exterior nozzle system which is self-contained and needs no outside power source, consists of six dry chemical tanks, and each piped to an external nozzle that can provide a dense curtain of dry chemical covering the entire roof area of the tank. This system is controlled by pneumatic heat detection equipment sensitive to rate of temperature rise. An interior nozzle system which is activated manually, can discharge dry chemical into the interior of the reservoir at a point above the level of the liquid. The third phase of the fire fighting system consists of three dry chemical turrets and three WaterFOG nozzles which are remote controlled and can be discharged intermittently. A curtain of WaterFOG, operated by rate of rise temperature detectors, provides a protective cooling curtain between the control and compressor buildings and any fire in the reservoir area. The entire system is considered unique, since it can deliver all 30,000 lb of sodium bicarbonate-base powder onto and into the in-ground tank in less than 60 sec.

2714 APTIC NUMBER 21331

Padovani, Carlo
AIR POLLUTION, A NEW PROBLEM FOR COMBUSTION ENGINEERS: AN OPENING ADDRESS FOR AN AIR POLLUTION SEMINAR (Stockholm, January 27, 1970). (Inquinamento atmosferico, un nuovo problema per i tecnologi della combustione; una prolusione a un seminario sull'inquinamento atmosferico). Text in Italian. Termotecnica (Milan), 24(3):132-134, March 1970.

Combustion has been the most important source of air pollution, ever since man began to use fire. The consumption or processing of traditional fuels can be held responsible for 80-90% of the air pollution caused by human activity. Pollution sources can be classified into 3 groups: home heating, vehicular traffic, and industry. The means of pollution control can be classified as: 1) control of raw materials and industrial processes, 2) control of emissions, and 3) controls administered subsequent to emissions (such as high chimneys). Until recently, the main concern of combustion engineering was increased output, efficiency, and versatility. Many of the advances made in the last 50 years have been in the direction of a less complete combustion, giving rise to increased air pollution. This is especially noticeable in the automotive industry. The basic problems now confronting combustion engineering are the development of burners that approach as nearly as possible the perfect combustion of stoichiometric mixtures, and the development of motors that will use 'lean' rather than 'rich' mixtures of fuel and air without sacrificing performance. Problems related to the elimination of sulfur dioxide pollution are discussed. Pollution has become an international problem and must now be dealt with at that level. Common criteria and standards must be agreed upon; a common language, units of measurements, and sampling techniques must be adopted; a common effort must be made to disseminate information; efforts must be made to redistribute the cost of antipollution measures, where these affect the cost of production; city planning must be discussed at the international level; and long-term programs must be devised and instituted to halt the rapid accumulation of people by large population centers.

2715 APTIC NUMBER 21078

Pap, Jeno
PROCESS FOR THE MANUFACTURE OF LIQUID SULFUR DIOXIDE. (Eljaras cseppfolyos kendioxid eloallitasara). Text in Hungarian. (Assignee not given.) Hungarian Patent 126899. 2p., May 15, 1961. (Appl. February 7, 1960, 2 claims.)

Liquid sulfur dioxide previously was prepared from waste gases in which it was contained by dissolving the mixture in water, driving off the SO2 by evaporation, and then compressing the SO2 gas. Such a process is expensive, since the gas mixture usually has a low SO2 content (6-10%), or else the SO2 has a low partial pressure, and the amount of SO2 obtained from the water is rather small. Experimental data show that at low temperatures there is a rapid increase in the amount of SO2 dissolved. If for water one substitutes a salt solution as solvent, this temperature can be lowered still more. It is thus possible to dissolve 10% or even as much as 20% SO2 in the salt solution at a temperature of 10-20 C, as compared with 1-2% SO2 in water alone. The process described by the invention is based on this phenomenon.

2716 APTIC NUMBER 20304

Parker, Robin J.
TWO-STAGE HYDROGENATION OF AN AROMATIC HYDROCARBON FEEDSTOCK CONTAINING DIOLEFINS, MONOOLEFINS AND SULFUR COMPOUNDS. (Universal Oil Products Co., Des Plaines, Ill.) U. S. Pat. 3,494,859. 6p., Feb. 10, 1970. 5 refs. (Appl. June 7, 1967, 10 claims).

An aromatic hydrocarbon feedstock containing diolefins, monoolefins and sulfur contaminants is hydrogenerated at a relatively low temperature of 200-500 F with a composite catalyst of lithium in palladium-alumina to convert the diolefins to monoolefins. The effluent is separated and an aromatic hydrocarbon is then hydrogenated at a relatively high temperature of 550-750 F with a conventional desulfurization catalyst to saturate olefins and convert sulfur compounds to hydrogen sulfide. Hydrocarbons suitable for gasoline blending and aromatic hydrocarbons suitable for solvent extraction are recovered as separate product streams. The method finds particular utility in stabilizing pyrolysis gasoline. (Author abstract)

2717 APTIC NUMBER 21249

Parson, James W.
COST OF CRYOGENIC STORAGE CUT BY USE OF 9% NICKEL STEEL. INCO Nickel Topics, 17(8):2-3, 1964.

Three materials are in general use for cryogenic storage. They are 5083 aluminum, Type 304 nickel stainless stee., and 9% nickel steel. The latter offers an economic advantage. Of prime consideration in selecting material for cryogenic storage is notch toughness, which is essentially the ability of a material to absorb energy at a given temperature level. All three of the above materials have demonstrated notch toughness at temperatures down to minus 320 F. These materials are used to construct double-walled above-ground storage tanks for cryogenic materials. This type of container, when properly insulated with perlite, exhibits many advantages over other storage methods.

2718 APTIC NUMBER 20297

Pausch, Josef
MEANS FOR CLEANING DUST SEPARATING APPARATUS. (Aerodyne Machinery Corp., Hopkins, Minn.) U. S. Pat. 3,499,268. 5p., March 10, 1970. 15 refs. (Appl. July 12, 1968, 1 claim).

The discharge of accumulated dust from a porous filtering element is cleaned by backwashing the filter with clean gas. The high energy gas is introduced into an injector, the outer open end of which is formed on an outwardly curved 'bowl-shaped' portion. This portion joins a passage of a smaller diameter to induce some ambient air into the column of high energy gas, and to project the combined gases with considerable pressure into the interior of the filter. A zone of high pressure is formed which is partially surrounded by a zone of lower pressure. Additional ambient air may be induced into the stream through independent passages. (Author abstract modified)

2719 APTIC NUMBER 21238

Pearson, J. L., G. Wonhebel, and P. H. H. Uhlander
FLUE GAS CLEANING AT FULHAM POWER STATION. Fuel Econ., vol. 12:104-109, Dec. 1936.

A washing cycle for flue gases which completely eliminates scaling problems is described as applied to a power station. The process depends upon a property of calcium sulfite and sulfate, their ability to very readily form stable supersaturated solutions, with the corollary that precipitation takes place very slowly from these solutions. A grid system was employed to provide maximum absorbing surface for the liquid. A flue-gas scrubber may be subjected to rapidly varying loads, so the acid and alkali constituents of the liquid must be monitered constantly. This can easily be accomplished with a pH recorder.

2720 APTIC NUMBER 20759

Pelletier, Eugene
INCINERATOR. (Raymond Lee Organization, Inc., New York)
U. S. Pat. 3,485,190. 2p., Dec. 23, 1969. 6 refs. (Appl. July 15, 1968, 5 claims).

An incinerator in which garbage and other waste is burned consists of a vertical chimney which passes upward through a multistory building; each floor has an access door through which waste can be thrown downward into the chimney. A firebox with an ash pit is at the base of the chimney and has jets of flame injected downwards. The waste is caught by dampers, disposed above the jets, which operate automatically or manually to feed the waste to the flames. Fans are situated in the chimeny above the hightes story to create a forced upward draft. Electrical heating coils, above the fans, completely burn the combustion products, such as flyash, drawn upward from the jets. This ensures complete burning prior to discharge to the atmosphere.

2721 APTIC NUMBER 21267

Penny, Noel
WHY GAS TURBINE WILL BE THE ENGINE OF TOMORROW. Engineer (London), 230(5957):23-26, March 26, 1970.

There is considerable evidence that the automotive gas turbine possesses the necessary qualities and the greatest possible scope for development to meet the future energy requirements of surface transport. More than 25 yrs of intensive development of aircraft gas turbines has yielded considerably improved efficiencies and high-temperature material properties. These results have been combined with the development of rotary heat exchangers and ceramic materials to produce an engine with a fuel consumption comparable to that of the diesel. At present, development work is aimed at a gas turbine for the upper end of the vehicle power spectrum, particularly the design of an engine with a life of up to half million miles. The potential application of high-power gas turbines include large trucks and buses; high-speed trains; off-road vehicles for construction and mining; and marine propulsion units. Additional applications cover the field of electrical generator sets; pumps, compressors, and drilling rigs; and total energy systems. It is hoped that the successful introduction of the gas turbine into heavy vehicles will enable it to be produced in the form of a small, sealed, and expendable unit of lower specific cost than ever known. The power level and operating range of a gas turbine are graphically compared with those of other power plants.

2722 APTIC NUMBER 20541

Pepper, Leonard
INVESTIGATION OF CEMENT-REPLACEMENT MATERIALS. TESTS OF SAMPLES OF FLY ASH. SUTTON RESERVOIR PROJECT. Army Engineer Waterways Experiment Station, Vicksburg, Miss. CWI Item 601, Miscellaneous Paper 6-123, Sept. 8, 42p., March 1962. 6 refs.

Twenty samples of the fly ash used in the Sutton Reservoir Project were tested at the Ohio River Division Laboratories (ORDL) and the Waterways Experiment Station (WES). The tests conducted at ORDL were part of the routine acceptance testing performed for the project, whereas the tests conducted at WES were to determine whether the test results are reproducible by different laboratories with the objective of improving Corps of Engineers specifications and test methods for pozzolans. The check test results were analyzed by a technique derived from Youden and Crandall and Blaine. For each property tested, the results at one laboratory were plotted against the results of the other laboratory, yielding one point for each pair of tests on one sample. The error standard deviation appeared to be at a satisfactory level for 9 of the 14 tests used to evaluate the fly ash; high deviations were obtained for the following: SiO_2 + Al_2O_3 + Fe_2O_3; MgO; autoclave expansion; air permeability fineness; and mean particle diameter. The difference between the results obtained by the two laboratories was significant for 8 of the 14 tests: SiO_2 + Al_2O_3 + Fe_2O_3; MgO; SO_3; air-permeability fineness; mean particle diameter; specific gravity; shrinkage increase; and water requirement. Test results obtained by ORDL on 274 samples are summarized. A total of 36.7% failed to comply with the requirements of the Sutton Project specifications. (Author summary modified)

2723 APTIC NUMBER 11819

Perasso, David, Mona Sarfaty, D. Ben Brown, Carl Goodwin, and Andrew Joseph
A PROPOSAL FOR THE INSPECTION AND MAINTENANCE OF AUTOMOBILE EMISSION CONTROL SYSTEMS. In: Air Pollution Project: An Educational Experiment in Self-Directed Research, Summer 1968. Associated Students of the California Inst. of Tech., Pasadena, p. 281-317, 1968. 37 refs.

Emissions from motor vehicles are of such magnitude that the State of California and the federal government have enacted legislation requiring new motor vehicles to meet certain emission standards. By and large, new motor vehicles have met these standards. However, as the engine is used, the effectiveness of its control system deteriorates and the amount of hydrocarbons, carbon monoxide, and nitrogen oxides emitted increases. Previous attempts to reverse this trend or to tune up older cars for low

emissions have failed because not enought diagnostic information was gathered. Yet, a 1 to 1-1/2 min test consisting of measuring the emissions at several modes of engine operation, coupled with simple under the hood examination, can provide adequate diagnostic information about an vehicular emission problems. If subsequent repairs were detailed by the inspector, an emissions reduction would be virtually guaranteed. Such a system could also be used on preemission controlled cars. The total reduction of contaminants would be approximately 19% for HC and CO and 5-10% for NOx. The cost of inspection would be approximately $3.00. In addition to reducing air pollution, the system should reduce the cost of car maintenance by providing accurate diagnosis of many potentially expensive engine problems. (Author abstract modified)

2724 APTIC NUMBER 21541

Perret, Jean
TECHNIQUES IN THE LIQUEFACTION OF NATURAL GAS. Petrol. Times, 70(1807):1537-1539, Nov. 11, 1966.

The most economical refrigeration system for natural gas liquefaction is presently a cascade of several refrigerating-fluid cycles, with each of the fluids pumping heat within its practical limits. Propane is generally used for the first refrigerating fluid, ethane or ethylene for the second, methane for the third, and nitrogen if a fourth if necessary. When the gas pressure increases, the temperatures during condensation increase also and cause the work of pumping this heat to decrease. The third cycle may be closed or open, depending mainly on the nitrogen content of the natural gas and also on the requirements of the plant for fuel gas. Various aspects of the liquefaction of methane are discussed, as well as an incorporated cascade or mixed-fluid cycle which uses a mixture of light hydrocarbons and nitrogen as refrigerating fluid. Only one compression is used, in one or two stages. The plant at Arzew, Algeria, and a proposed open cycle and two-pressure cycle are described briefly. These systems are simpler than the standard cascade cycle when considering compression.

2725 APTIC NUMBER 21355

Peterson, M. W.
GAS CLEANING FOR THE ELECTRIC FURNACE AND OXYGEN PROCESS CONVERTER. American Inst. of Mining, Metallurgical and Petroleum Engineers (AIME), New York, N. Y., Proc. An. Inst. Mining Met. Petrol. Engrs. Conf. Electric Furnace, 1956, vol. 14:262-271.

Waste gas cleaning methods for the oxygen converter steelmaking process and 200-ton electric-arc furnaces are reviewed. To cool the dense red smoke produced by the oxygen process to a volume that can be handled, the gases are first cooled to 550-800 F by water sprayed in a spark box located adjacent to the hood covering the mouth of the vessel in which the process is carried out. The gases are then passed upward through a gash washer's four banks of ceramic tiles. The washer has a water spray of 2200 gpm. With 50 F water, the gas temperature is reduced to 85 F. From the washer, the gases are carried to a Freyn disintegrator, where the moisture eliminator fine-cleans them prior to discharge through the stack. The operation of the electric-arc furnaces produces fine dust and fumes which pollute the atmosphere in the vicinity of the melt shop. The procedure used to treat these emissions is similar to that employed for the oxygen process. The gases are drawn off through a water-cooled vent elbow, passed through a spark box, where they are water cooled to 550 F, then carried to the gas washer and passed upward through banks of ceramic tiles. Twenty-two hundred gallons of water per min pass down through the washer concurrent to the flow of gas. In the washer, the temperature is reduced to 125 F, and most particles larger than 5 micron are trapped. After being washed, the gases are treated in a pressure disintegrator and moisture eliminator.

2726 APTIC NUMBER 21527

REPORT ON FROZEN EARTH STORAGE. Petrol. Management, 37(1): 157-158, Jan. 1965. (Adapted from a paper by P. S. Massey, presented at the 43rd NGPA Annual Meeting, New Orleans, La.)

The construction of a 160,000 bbl frozen-earth storage facility for propane is reviewed, and the costs of frozen earth storage are compared with other methods of propane storage. The frozen storage facility is an unlined pit excavated from water-bearing, mixed soil. Construction began by setting freeze pipes to a depth of 155 ft. The first phase of construction was completed with the installation of refrigeration equipment connected to the freeze pipe system. Propane was introduced to the system and freezing of the ground was begun. When a complete frozen ring of the proper thickness was obtained, excavation began. As the excavation progressed, an insulated, gas-tight steel roof was lifted into position. The facility cost about $4.75/bbl storage investment as against an estimated $5.50/bbl for aboveground storage. It is possible that liquefied natural gas could also be stored in frozen earth.

2727 APTIC NUMBER 21587

PIPELINES FOR L.N.G? Petrol. Times, 72(1848):843, June 7, 1968.

Little research work has been done on transmitting liquefied natural gas through LNG pipelines longer than 5 miles rather than through existing gas transmission lines. A new approach, based on the copper tubes used for microwave transmission cables and for cryogenic transfer lines, is represented by a double-wall corrugated tube fabricated from stainless steel strip with welded seams. A spirally wound plastic spacer is located between the copper tube walls, and the outer tube is sheathed in white plastic. In the steel tube, the plastic spacer is replaced by a light stainless steel strip. Tests on specimens have yielded high bursting pressures and extremely low rates of 'outgassing'. Production is anticipated of stainless tubes up to 12-in od, capable of sustaining an internal pressure of 1000 lb/sq in, and operating at an acceptable heat leak without continuous pump-out of the annular space, for intervals of two to three years. Machines for the production of the pipes could be mounted on a trailer for production in situ.

2729 APTIC NUMBER 21168

Petsinger, R. E. and C. C. Hanke, Jr.
DESIGN OF 9% NICKEL STORAGE TANKS. Cryogenic Eng. News, vol. 1:26-30, Oct. 1966.

Cryogenic tanks store natural gas at -259 F, then vaporize it when necessary to meet peak consumer loads, as it can be reduced in volume by a factor of 630 when liquefied. The features and principle advantages of the tanks such as those built for Alabama Gas and San Diego Gas and Electric are described in relation to their double-wall design and 9% nickel steel composition. Outer tanks may be made of carbon steel as they will experience only ambient temperatures, but the inner tank must be made of special materials capable of resisting brittle fracture at LNG temperature, of which 9% nickel steel is the most economical for a large flat-bottom structure. Evidence of the vessel's integrity with respect to design and leak tightness, including foundation, it obtained through a hydrostatic overload test performed prior to placing the vessel in service. Proper insulation is the key to successful and economical storage of any cryogenic material, and at these low temperatures the vapor barrier is a vital part of the insulation system. To absolutely minimize conduction of atmospheric heat to the inner tank, the only through-connections between the inner and outer tanks are necessary piping designed to accommodate thermal contraction and expansion. The most commonly used insulation is perlite, a fine, granular material thermally expanded from a volcanic rock.

2729 APTIC NUMBER 21612

Petsinger, Robert E.
LNG ON THE MOVE. PART 2-OVER THE WATER. Gas., 44(1):41-48, Jan. 1968.

Interest in marine transportation of liquefied natural gas (LNG) dates back to 1951. Technical feasibility was established in 1959, and regular deliveries began several years later. A new development in the design of LNG tankers is the abandonment of separate tanks for a thin, impervious lining supported by insulation. Examples of this and other prototype designs are given. The three international transfer and storage facilities are examined as well as projected facilities. An analysis of major markets for LNG importation and the nearest major supplier is discussed. The international movement of LNG is growing, and is expected to continue to grow. Technical progress promises to lower costs associated with LNG. Extensive offshore drilling for oil and gas has located sizeable reserves. As potential applications for LNG prove themselves, the demand for LNG will grow.

2730 APTIC NUMBER 20679

Pinto, Herbert
AIR CLEANING DEVICE. (Assignee not given.) U. S. Pat. 3,483,677. 3p., Dec. 16, 1969. 11 refs. (Appl. Feb. 6, 1967, 1 claim).

A unitary air cleaning assembly removes both moisture and particulate matter from the output of air compressors. Incoming air is centrifuged to remove moisture droplets. It then passes through a bed of hydrophilic materials which removes the remaining moisture and coarse particles. Fine particles are removed by a secondary filter prior to exit of the air from the filter assembly. The unit provides efficient cleaning in minimum space with relatively low back pressure. No quantitative data on particle or moisture removal are provided. (Author abstract modified)

2731 APTIC NUMBER 20448

ROUNDUP OF LNG FACILITIES IN THE UNITED STATES. Pipe Line Ind., vol. 23:39-44, Oct. 1965.

Liquefied natural gas (LNG) storage facilities either built or projected by U. S. gas distributors and transmission companies are enumerated and briefly described. Companies included are: Wisconsin Natural Gas Company, Alabama Gas Works, San Diego Gas and Electric Company, Memphis Light, Gas and Water Div., Philadelphia Gas Works, Transcontinental Gas Pipe Line, Tennessee Gas Transmission, and Texas Eastern Transmission. Liquefaction, storage, and revaporatization capacities are explained; estimated costs are tabulated. Flow diagrams of the processes are included.

2732 APTIC NUMBER 21536

LNG COMES OF AGE. THE BIG FREEZE. Pipeline Eng. vol. 38: 40-45, Feb. 1966.

Space savings over gaseous storage are so large that sufficient gas, in liquid form, can be stored in summer to supply peak winter demand. By lowering the temperature of natural gas to -260 F, 632 cu ft of gas can be crowded into one cu ft of liquid. Geography and geology do not restrict the application of LNG, and the pipelines maintain a high year-round load factor while improving gas supply service to customer utilities. The world's largest LNG plant is at Arzew, Algeria, from where the liquid methane is shipped by special tanker to Britain and France. Numerous other LNG facilities are under construction or in operation in many countries. Highlights of nine LNG facilities now underway, operational, or proposed in the U. S. are listed.

2733 APTIC NUMBER 21317

Poenler, H.
STATE OF THE ART OF NEW DRIVES FOR VEHICLES AND THEIR EMISSIONS. (Entwicklungsstand neuer Antriebsarten von Kraftfahrzeugen und ihre Emissionen). Text in German. VDI (Ver. Deut. Ingr.) Ber., no. 149:69-88, 1970.

Four new drives have a realistic chance to replace the conventional combustion engine of automobiles: the electromotor,

the steam engine, the Sterling motor, and the hybrid drive. Electrically driven cars are free of any emissions and make a low noise. They are able to reach speeds of more than 50 km/hr and accelerations of more than 1.5 m/sq sec. Ford has come out with a lead battery driven electric car. This battery will soon be replaced by a sodium-sulfur battery. General Motors introduced electric cars with a silver-zinc battery, or an H2-02 fuel cell battery as the energy source. In England, 60,000 electric cars are already in operation. Italy, Germany, and Japan came out with electric cars. The technical data of these cars are listed in tables. Steam engines are gaining interest mainly because of lower emissions as compared to Otto engines. Moreover, they need no clutch and gear, they have a long life span, and maintenance is low as is the noise. According to the California test of 1965, the steam engine emits 0.39 g hydrocarbons, 175 g carbon monoxide, and 0.68 g nitrogen oxides per km referred to a 2.3 liter gasoline engine. The Sterling motor is operated with fossile fuels. It emists 0.063 g hydrocarbons and 0.63g CO per km which is less than is emitted by the steam engine. Hybrid drives operate with a conventional lead battery parallel to a small combustion engine coupled with a dc generator. Germany has developed a bus with such a drive. Russia is about to construct a small bus for 10 passengers with hybrid drive.

2734 APTIC NUMBER 20310

Price, Harold A. and Donald A. Price
AIR POLLUTANT INCINERATION. (Gas Processors, Inc., Brea, Calif.) U. S. Pat. 3,472,498. 8p., Oct. 14, 1969. 3 refs. (Appl. Dec. 4, 1967, 8 claims).

Generally, the source of industrial pollutants are incomplete combustion products from heat generating processes and the discharge of combustible solvents which have been evaporated. One of the most common applications is found in painting processes where paints are dried by baking to leave a thin film of pigment on the item being painted. An incineration system is provided for preventing the discharge into the atmosphere of oxidizable waste particles from exhaust gases of ovens. Exhaust gas is mixed with a combustible gas to a level just above the lower explosive limit for the mixture, and the heated gas discharged by the incinerator is cooled preferably by mixing it with an adequate quantity of air at ambient temperature. Thereafter a blower propells the air and gas mixture to a location where thermal energy in the mixture is required and can be utilized, while the relatively small pressure drop across the combustion chamber, together with the substantially lower temperatures of the mixture, permit a highly economical construction and operation of the blower. A preferred embodiment of this invention contemplates a division of the air-gas mixture into two streams.

2735 APTIC NUMBER 20555

Proctor, R. C. and W. W. Bodle
GAS CONDITIONING FOR LIQUEFACTION. PART 1. Am. Gas J., 194(13): 68-77, Nov. 1967. PART 2. Ibid., 194(14):49-55, Dec. 1967. 19 refs.

Problems attending the liquefaction of natural gas are reviewed. In addition to its principle constituent, methane, the gas available to a liquefaction plant will contain minor constituents, such as nitrogen, helium, water vapor, carbon dioxide, hydrogen sulfide, organic sulfur compounds, ethane, and heavier hydrocarbons. It may also contain materials such as lubricating oil, amine, glycol, methanol, and odorant mercaptans. All these minor constituents will affect the liquefaction process in different ways and different degrees. Handling them to produce a suitable end product with a trouble-free operation in an economical manner, requires consideration of their effect on the clogging of liquefaction equipment with solids; methods of forestalling freeze-ups; the effect of varying stream compositions on the character of the liquefied natural gas (LNG) and return gas; and methods of controlling the character of LNG and return gas. The principal part of the paper is devoted to point 2. The known freezing points and ranges of freezing points of the pure constituents of natural gas are cited and their modification in binary solutions is considered. These thermodynamic data provided the basis for the methods of removal of water, carbon dioxide and hydrogen sulfide, mercaptans, and heavy hydrocarbons used in practice. Water may be removed with desiccants prior too refrigeration and may also be condensed and/or frozen out in the refrigeration process. Carbon dioxide and hydrogen sulfide may be removed with a 15 to 20% solution of monoethanolomine. Molecular sieves can simultaneously remove H2O, CO2, H2S, and mercaptans from the feed gas.

2736 APTIC NUMBER 21243

Proctor, R. C.
TRANSCO'S IN-GROUND STORAGE FACILITY SET TO BEGIN SERVICE THIS WINTER. Oil Gas J., vol. 62:92-93, Nov. 2, 1964.

The first commercial in-ground storage facility for liquefied natural gas (LNG) is located in the Jersey Meadows near Carlstadt, N. J. The natural gas liquefaction facilities may be divided into the following groupings: (1) feed-gas compression; (2) gas cleanup (removal of hydrogen sulfide and carbon dioxide); (3) liquefaction; (4) storage; and (5) vaporization of LNG. The in-ground storage unit is the largest ever built in the United States. On a peak day, 200 MM cu ft may be vaporized and delivered. The plant is capable of receiving 11.5 MM cu ft per day during the off season.

2737 APTIC NUMBER 20730

Ramires, Walter C.
INCINERATOR FOR BURNING COMBUSTIBLE WASTE AND METHOD. (Assignee not given.) U. S. Pat. 3,476,062. 5p., Nov. 4, 1969. 4 refs. (Appl. Dec. 13, 1967, 10 claims).

An apparatus is provided for aqueous scrubbing and mechanical drafting in the combustion zone and for comminuting of solid by-products to achieve essentially smokeless incineration of waste materials such as paper products, wood, garbage, and

combustible plastics. The incinerator includes a combustion chamber with a perforated, rotating grate; a rotary impeller chamber; and a scrubbing chamber. Rotation of the rotary impeller causes the effluent from the combustion process, some of which continues to burn as it passes through the scrubbing chamber, to be drawn into the eye of the impeller. A spray nozzle in the scrubbing chamber is directed at the eye of the impeller; it generates a full cone of water droplets which pass through the burning product advancing to the impeller for mixing with the products for joint centrifuging of the products and water in the impeller. In addition to providing positive drafting of the combustion chamber, the impeller also comminutes the solids in the effluents impinging on its face. Solids and gaseous matter are separated in a settling chamber downstream of the impeller, and the hot gases are recycled to the combustion chamber. The recirculation not only aids in the combustion of burning waste material but insures complete combustion of the recirculated gases.

2738 APTIC NUMBER 20668

Rando, Robert A. and James J. Rando
EXHAUST TREATING DEVICE. (Assignee not given.) U. S. Pat. 3,482,195. 6p., Dec. 9, 1969. 7 refs. (Appl. April 12, 1968, 6 claims).

An automobile exhaust treating device is described for burning carbon monoxide to form carbon dioxide. The generally tubular burning unit includes an annular electrical insulating unit which carries conductor rings and a multiplicity of tungsten vanes, while the burning device is surrounded by a cooling chamber and terminates in a mixing chamber. In a preferred form, an activated charcoal filter is also provided, and a pre-mixing chamber is disposed between the exhaust pipe and the burning unit for mixing the exhaust gases under pressure with air from the atmosphere to increase the efficiency of the burning process. A bracket secures the device to the exit end of an automobile exhaust pipe.

2739 APTIC NUMBER 21315

Rathgeber, Ferdinand
CLOTH FILTERS FOR DUST EXTRACTION. (Gewebefilter in der Entstaubungstechnik). Text in German. Wasser Luft Betrieb, 14(3):112-117, March 1970.

Tabular bag filters are the oldest type of cloth filters. The bags can be arranged in circular or rectangular form. The dust is mostly deposited on the inner side. Cleaning of the bags may be achieved by rapping or shaking or by a reverse air jet. The bags must be tightly suspended to prolong their life-span. The dust-laden gas flows into the bottom of the bags. A version of the bag filter developed in England consists of a cylindrical casing in which the bags are circularly arranged. They are pulled over a wire screen frame. Through centrifugal force, the coarse particles are precipitated in the lower section of the filter. Contrary to the common tubular bag filter, the dust is deposited on the outside of the bags. An air jet is used for periodic dust removal. Seven other types of bag filters are likewise described and illustrated. They differ mostly in their arrangement, suspension, and cleaning of the bags. Envelope type bag filters have the advantage of consuming less space than tubular bag filters. The dust is mostly precipitated on the outside. The various kinds of envelope filters distinguish themselves mostly by their clean device. Cloth filters can also operate at temperatures of the dust-laden gas of 270 C through the use of synthetic fibers and silikonized glass fibers.

2740 APTIC NUMBER 20656

Reeve, David Hulsizer
GAS SCRUBBER METHOD. (Effluent Controls, Inc., Lakeland, Fla.) U. S. Pat. 3,488,920. 7p., Jan. 13, 1970. 10 refs. (Appl. Oct. 24, 1967, 3 claims).

A gas scrubbing method is described which provides a high degree of contact between the contaminated gas and the scrubbing medium. The contaminated gas stream is mixed with sprayed liquid, e.g., water, in an inlet duct having a tapered section for accelerating the contaminated gas. The gas inlet duct extends downward to and tangentially with a cylindrical chamber whereby energy in the gas-water mixture is imparted to water whirling in the lower portion of the cylindrical chamber. After the gas-water mixture is compressed and admixed with the recycling water, the entrained water and contaminants are separated from the gas stream by extremely high centrifugal forces.

2741 APTIC NUMBER 21314

Regli, Giorgio
NEW PLANT FOR CLEANING THE EXHAUSTS OF DIESEL ENGINES. (Neue Anlagen fuer die Reinigung von Dieselmotor-Abgasen). Text in German. Schweiz. Bauztg., 88(13):293-296, March 26, 1970.

A cleaning device for the removal of hydrocarbons, aldehydes, sulfur dioxide, and soot from the exhaust of diesel engines operating in mines was developed in Switzerland. The device comprises a water tank, a nozzle, a cooler, a cyclone, and several layers of adsorbents. The water in the tank is activated with a cartridge containing NaOH and an emulsifier. The nozzle draws in the fluid from the tank and mixes it with the exhaust, forming steam and aerosols. The temperature is reduced in the cooler to 50 or 60 C. The major part of the water vapor is condensated. The cyclone separates the water from the exhausts. The water is returned to the tank. The aerosols are retained by the adsorbent layers of silica gel. This device has a high cleaning efficiency. It is not suitable for Otto engines, however. Disadvantages include the higher exhaust back pressure and the large volume and heavy weight of the engine.

2742 APTIC NUMBER 21119

Remmers, Karl and Rolf Pingel
THE IMPORTANCE OF GAS DISTRIBUTION IN ELECTROSTATIC PRECIPITATORS.

(Die Bedeutung der Gasverteilung im Elektrofilter) Staub (Duesseldorf), vol. 19:422-424, 1959. 5 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 11p.

It is important to distribute the gas flow from the feed lines as uniformly as possible over the cross section of the electrostatic precipitator with either horizontal or vertical flow arrangement. To avoid collection efficiency losses with new plants, it is advisable to conduct experiments with three-dimensional models. In such models, the velocity distribution over the precipitator cross section can be measured easily with a flowmeter. The collection efficiency as a function of the flow velocity for a three-stage electrostatic precipitator is shown. Velocity profiles in the precipitator model with gas distribution vanes and without installed gas distribution plates are illustrated. Computation of the collection efficiency loss at varying gas velocities in the invididual precipitator stages is tabulated. For a filter with straight gas feed, the separation loss is represented as a function of the number of gas distributor plates.

2743 APTIC NUMBER 20306

Penault, Philippe and Sigismond Franckowiak
PURIFICATION OF GASES CONTAINING ACIDIC IMPURITIES. (Inst. Francais du Petrole des Carburants et Lubrifiants, Rueil-Malmison) U. S. Pat. 3,495,933. 7p., Feb. 17, 1970. 6 refs. (Appl. March 18, 1966, 8 claims).

For purification of gases containing hydrogen sulfide and hydrocarbons boiling higher than methane, a liquid phosphoric acid ester is employed as an absorbent to remove the H2S and hydrocarbons. The loaded phosphoric acid ester is extracted with an immiscible solvent selective for H2S, e.g. aqueous inorganic basic solutions or aqueous glycolic solutions, and both the phosphoric acid ester and the resultant solvent are desorbed to recover hydrocarbon and H2S gases in separate streams. Tri-n-butyl orthophosphate is the most preferred ester because its selectivity is particularly acute, and its solubility in water is relatively low, which facilitates washing operations. Scrubbing the gaseous stream with the phosphoric acid ester is conducted at superatmospheric pressures, generally about 10-200 atmospheres absolute, with the preferred temperature range at -20 to +60 C. A supplementary treatment comprises contacting the gas with a solution of an amine, an alkanolamine, or mineral base in water and/or in organic solvents. (Author abstract modified)

2744 APTIC NUMBER 21433

Berolle, R.
ARZEW MASTERS LNG OPERATING PROBLEMS. Hydrocarbon Process., 47(8):115-117, Aug. 1968. (Presented at the First International Conference on LNG, Chicago, Ill., April 7-12, 1968.)

Startup and operating problems encountered by a natural gas liquefaction plant in Algeria are reviewed. The plant, constructed to liquefy 1.5 billion cu m of gas per year, uses a cascade cycle with three cold-producing cycles of propane, ethylene, and methane. The compressors for the cycles are driven by a steam turbine. The plant has its own steam-generating plant and also produces the electricity and soft water required for the cycles. Refrigeration is done using sea water. During startup, numerous problems were caused by safety devices in the coolant circuit and energy-producing installations. While making the required technical changes, improvements were also made in operating techniques and the power output of the turbines was increased. The latter step increased the capacity of the plant 30% above its original rating. Actual runs, however, produce only more than 10% of the rated output. Among the main reasons are problems connected the purity of the refrigerating fluids, the cleanliness of sea water-fed exchangers, turbo-compressor breakdown and a gas purification unit for heavy hydrocarbons. Accidents are another cause of stoppages. Nevertheless, plant operations have been simplified in two key areas. To make the cold chests and the double walls of the storage reservoirs harmless, nitrogen was replaced by a flash gas containing 50% N2 and 50% CH4. This enabled the elimination of N2-producing units. Also, the plant has ceased to produce the ethylene used in the cycle.

2745 APTIC NUMBER 21549

Resnick, Irving
LIQUEFACTION, STORAGE AND REGASIFICATION OF NATURAL GAS. Am. Gas Assoc., Proc., vol. 31:840-842, 1949.

Liquefied natural gas storage can supply the sudden or exceptionally high peaks of demand for natural gas caused by abrupt changes in weather as well as furnish gas for emergency use in the event of a pipeline failure. One cubic foot of liquid natural gas at atmospheric pressure will produce approximately 600 cubic feet of free gas at ordinary temperature. Liquefaction permits the storage of large volumes of natural gas at lower investment cost than is possible by any other means. Such a plant offers extreme flexibility in operation; during the same day it would be possible to send out gas during the period of maximum demand and to liquefy and store during low-demand hours. For a plant that is operated for peak loads only, the storage tanks need not be maintained full during the summer months, although for emergency service they should be full at all times. The two main processes that are thermodynamically efficient for liquefying natural gas are the expander cycle and the cascade refrigeration cycle. Where the peak sendout rates are high (48 MMCFD and larger) an LNG facility is more economical than a propane-air plant, besides providing insurance in case of pipeline break, returning a gas which is 100% interchangeable, and being independent on an outside liquid fuel supply.

2746 APTIC NUMBER 21580

Richard, Lucien and Maurice Biais
THE EXPERIMENTAL NATURAL GAS LIQUEFACTION AND LIQUID METHANE STORAGE AND REGASIFICATION STATION SET UP AT NANTES. (La

station experimentale de liquefaction de gaz naturel, de stockage et regazeification du methane liquide, de Nantes). Text in French. Compt. Rend. Congr. Ind. Gaz, vol. 78:655-682, 1961.

Since 1958, Gaz de France has been studying problems connected with the sea transport of liquefied natural gas at -160 C and under atmospheric pressure. The Experimental Natural Gas Liquefaction and Liquid Methane Storage and Regasification Station was constructed at Nantes and commissioned in 1960. The station conducts several experimental studies including the thermal stresses, heat insulation systems, accessories for tank temperature control, and safety devices for the storage tanks. The plant for the regasification of liquid methane under pressure, and very low temperature equipment are also investigated, along with measuring and monitoring devices. The stock of 500 cu m of liquid natural gas made available will allow sea trials of various types of tanks, heat insulation systems, pumps, and safety devices to be made.

2747 APTIC NUMBER 20363

Ridley, Richard D.
DESULFURIZATION OF COKE. (Tidewater Oil Co., Los Angeles, Calif.) U. S. Pat. 3,472,622. 4p., Oct. 14, 1969. 3 refs. (Appl. Sept. 19, 1966, 7 claims).

A complete process is described for the desulfurization of carbonaceous solids, in particular, fluid coke derived from petroleum residuums. The process involves mixing the raw coke with a finely divided alkali metal sulfide, such as sodium sulfide, and passing hydrogen gas through the mixture at moderate temperatures (1200-1800 F). Sulfur is removed from the coke primarily as hydrogen sulfide, is separated from the unreacted hydrogen, and recovered by conventional means. The reacted coke and sodium sulfide are separated by water washing, the sodium sulfide being water soluble. Spray drying returns the sodium sulfide to its original condition so that it may be recycled. Unlike many known desulfurization processes, this process is preferably carried out at atmospheric pressure; thus, there is no need for costly pressure equipment. The time required to desulfurize the coke by the process varies with the original sulfur content of the coke and the temperature of the reaction. In general, a period of 10 min to three hrs in the kiln is sufficient. Under optimum conditions, adequate desulfurization of a coke containing 6% sulfur can be achieved within one or two hrs at 1200 F. (Author abstract modified)

2748 APTIC NUMBER 20367

Ridley, Richard D.
DESULFURIZATION OF PARTICULATE COKE. (Tidewater Oil Co., Los Angeles, Calif.) U. S. Pat. 3,472,624. 4p., Oct. 14, 1969. 4 refs. (Appl. April 5, 1967, 4 claims).

An effective and economical process for the desulfurization of coke and similar carbonaceous material is described. A supply of fluid coke is first screened to give a minus 60 plus Tyler mesh fraction and a minus 150 plus 200 Tyler mesh fraction. The latter fraction is then impregnated with sodium sulfide and re-screened to minus 150 plus 20 mesh. The two fractions, each containing approximately 6% sulfur, are combined and heated together in a kiln in a hydrogen atmosphere at 1100-1600 F and atmospheric pressure. In some way, the use of carbonaceous material as a carrier for the desulfurizing agent provides for effective desulfurization of the unimpregnated fraction. Under optimum conditions, adequate desulfurization is usually achieved within 1 to 2 hrs. After the reaction, the desulfurized fraction is recovered by classification, while the sodium sulfide from the impregnated fraction is reheated and recycled to the kiln.

2749 APTIC NUMBER 21519

Riesenfeld, Fred C. and Clyde L. Bloha
ACID GAS REMOVAL PROCESSES COMPARED. Hydrocarbon Process Petrol. Refiner, 41(4):123-127, April 1962. 14 refs.

Recently developed methods are reviewed for processing natural gas streams containing unusually high concentrations of acid gases; the older amine processes, while still suitable for some applications, suffer from high heat consumption during solution regeneration and are subject to chemical degradation. For removal of carbon dioxide, the hot potassium carbonate process and its modifications, such as the Giammarco-Vetrocoke and the Catacarb process, are suitable in cases where the partial pressure of CO2 in the feed gas is above 10 psi, preferably within the range of 20-100 psi. Processes using physical solvents, such as the Fluor process which utilizes propylene carbonate as the solvent, become more attractive as the partial pressures increase. Advantages of hot potassium carbonate and physical solvents for simultaneous CO2 and hydrogen sulfide removal include fairly low heat consumption, relative freedom from corrosion, low chemical losses, and high solution capacity. An adsorption process using molecular sieves has been tested in pilot plants and one small installation. No process has yet been developed which satisfactorily solves the basic problems in selectively removing H2S in the presence of CO2; various methods involving liquid oxidation, preferential absorption in liquid media, and molecular sieve adsorption are in operation or are being tested for this purpose.

2750 APTIC NUMBER 20738

Rinaldi, L. and G. Sotgia
FURTHER STUDIES AND OBSERVATIONS OF THE BEHAVIOR OF SMOKE FROM LARGE POWER PLANTS, MAKING USE OF HYDRODYNAMIC MODELS. (Ulteriori sviluppi di studi ed esperienze relativi al circuito dei fumi per centrali di grande potenza, mediante l'impiego di modelli fluidodinamici). Text in Italian. Termotecnica (Milan), 23(11): 544-552, Nov. 1969. 12 refs. (Presented at the Congress Nazionale ATI, 24th, Bari, Oct. 1969.)

A smoke behavior model of a particularly compact configuration was the subject of experiments aimed at obtaining a more rigid control over the flow of smoke in an electrostatic filter. After examining such problems as the structure of the circuit, its lateral position with respect to the stack, and the high degree

of regularity required, criteria are formulated for the proper solution of the problem. Also examined critically is the degree of approximation of the parameters normally used to correlate the quality of flow distribution, observed from the model, with the purifying efficiency of the actual electrofilter. The problem of insufficient diffusion created by the strong divergence of the air ducts can be corrected, despite the difficulties, with a system that combines deflectors and screens, which should also permit a reduction of the total weight of the system.

2751 APTIC NUMBER 20263

Bishavy, E. A., W. D. Bond, and T. A. Zechin
ELECTROVAIR A BATTERY ELECTRIC CAR. SAE (Soc. Automotive Engrs.) Trans., 76(2):981-991, 1023-1028, 1968. 1 ref. (Paper 670175.)

In evaluation tests of two experimental cars, electric power output of 120 kW was handled safely, along with 350 amp currents and a 530 V open circuit source; problems which still must be solved were more accurately defined as low mileage range, short battery life, long recharge time, weight and size, costly components and materials, sensitivity of the motor control system to electrical noise, difficult cooling requirements, special auxiliary power requirements, new safety problems, and radio and TV interference. A 1964 Corvair was chosen for the first conversion to an electric drive, and Electrovair II was built from a 1966 Corvair. The battery pack had 286 silver-zinc cells which were assembled in 13 trays with 22 cells in each tray: seven of the trays were in the front luggage compartment and six in the rear. The front batteries were cooled by ram air and the rear pack was cooled by forced air from the oil cooling fan. Silicon controlled rectifiers were used to invert dc power to three phase ac power of controlled frequency and voltage. Low power logic circuits were mounted in the right rear fenderwell and inverter trigger circuits in the left rear fenderwell. The cooling system consisted of a pump, a radiator, a reservoir, and a fan; and oil was circulated from the radiator, through the modulating inverter, to the motor, and then back to the radiator.

2752 APTIC NUMBER 21051

Roberson, James E.
THE EFFECT OF ODOR CONTROL ON A KRAFT MILL ENERGY BALANCE. J. Air Pollution Control Assoc., 20(6):373-376, June 1970. 3 refs.

Thirteen different recovery unit odor control cases are analyzed to determine the variation in energy costs for a kraft mill. Incineration or scrubbing is often used to reduce odors, except for the recovery unit which is the greatest offender. Oxidation or removal of the direct contact evaporator appears to be the most reasonable method of reducing the odorous emissions of hydrogen sulfide. New recovery systems, which eliminate the direct contact of flue gas and black liquor, have several variables that affect energy costs: steam coil air heaters, recirculating air heaters, regenerative air heaters, 55% to 60% solid evaporators, and large economizers. These variations are calculated and presented as energy balances, indicating that energy costs for various odor control systems are of sufficient value to be considered during evaluations. The newer recovery systems have the lowest expected fuel cost as well as significant chemical cost savings. Capital costs, fuel costs, and acceptable emission levels should all be considered before arriving at a total odor control system evaluation.

2753 APTIC NUMBER 21673

Roe, Joseph T.
CAN NATURAL GAS SOLVE THE AIR POLLUTION PROBLEM? Gas, 46(6):69-70, June 1970. 2 refs.

Use of natural gas as a fuel could contribute to a significant reduction in air contaminants. Burning gas produces practically no sulfur oxides or particulates, while reducing the other major pollutants by as much as 70%. Natural gas would decrease the pollutants from power plants by about 16 million tons per year, and similar reductions could be achieved in the emissions from automobiles, heating, and industry. Unless an increased rate of discovery and buildup of reserves occurs, natural gas will not be able to supply all the various industries with their required fuel supply. Tables of total emissions, sources, and usable energy are included.

2754 APTIC NUMBER 21203

Romovacek, Jiri and Jaroslav Pohl
APPARATUS FOR THE PREPARATION OF GASEOUS MIXTURES WITH LOW SO2 CONCENTRATION. (Apparatur zur Herstellung von Gasgemischen mit kleiner SO2-Konzentration). Text in German. Erdoel Kohle (Hamburg), 23(5):294-296, May 1970. 13 refs.

A gaseous mixture with sulfur dioxide concentrations of 0 to 1 mg/cu m is obtained by continuously adding dichlorsulfitomercurate-(II) to sulfuric acid and by diluting the liberated SO2 with a regulated flow of carrier gas. The solution of dichlorsulfitomercurate-(II) is pumped peristaltically into a spiral-shaped glass column simultaneously with the H2SO4. The spiral column has an inner diameter of 8 mm and a length of 800 mm. The carrier gas nitrogen is taken from a pressurized gas bomb, and is cleaned with solid NaOH. The speed of the carrier gas is controlled by a manometer. A constant SO2 concentration was produced in long-term experiments.

2755 APTIC NUMBER 21233

Rorschach, Robert L.
LOW-TEMPERATURE PROCESSING. PART II. REFRIGERATION CYCLES AND EQUIPMENT. Oil Gas J., 64(24):90-95, June 13, 1966. 3 refs. Part I. Ibid., 64(22), May 30, 1966. PART III. Ibid., 64(25), June 20, 1966.

A critical analysis of the two methods by which designers may elect to reach the low-temperature range is presented. The two methods

are by heat transfer to an external refrigerant fluid and self-refrigeration of the process fluid. The former is subdivided into vapor-compression cycles and absorption cycles. Equipment which can be used to reach the low temperature is reviewed. Equipment which can be used to reach the low temperature is reviewed. Equipment categories include heat-exchangers, regenerators, compressors, expansion engines, pumps, and storage tanks. Several types of storage tanks are discussed. Additionally, pipes, valves, fittings, and controls are mentioned. The principle design considerations for each category of equipment are considered. Performance considerations are weighed against capital investment and operating costs in making qualitative choice decisions. Aboveground storage of liquefied natural gas is discussed with respect to single-wall and double-wall tanks. Underground concrete tanks are favorable for sizes exceeding 100,000 bbl. Frozen earth storage are being tried for products at both ends of the low temperature scale: propane at -56 and LNG at -258 F.

2756 APTIC NUMBER 21349

Rosen, Ward D.
HERE'S A QUICK DESIGN METHOD FOR AMINE SWEETENING PLANTS. Oil Gas J., 66(12):75-78, March 18, 1968.

A data sheet and design charts provide quick estimates of equipment size for a plant which uses an amine sweetening process to remove hydrogen sulfide and carbon dioxide from natural gas. The size of equipment in most amine plants is a direct function of the amine circulation rate, which in turn is directly proportional to the volume of acid gas contained in the sour-gas stream. Design data needed for accurate size estimations are maximum flow rate of the sour gas, in thousands of cu ft per day; maximum total acid-gas content of sour gas, volume percent of H2S and CO2; and maximum pressure at which the gas will be treated.

2757 APTIC NUMBER 20328

Rosenberg, Robert M., Sanford A. Weil, and William R. Staats
METHOD AND APPARATUS FOR AVOIDING EXHAUST PLUMES. (Inst. of Gas Technology, Chicago, Ill.) U. S. Pat. 3,499,717. 9p., March 10, 1970. 3 refs. (Appl. Nov. 26, 1968, 14 claims).

A method and apparatus is described which avoids the formation of an exhaust plume, such as is formed upon combustion of a hydrocarbon fuel in a gas space heater, by raising the enthalpy or heat content of the flue gases to a level above that at which the gaseous water condenses. It is possible to determine the amount of heat energy necessary to raise the enthalpy of the flue gas to a level to prevent condensation by determining furnace efficiency, ambient temperature, and relative humidity. Condensation is affected by chemicals and dust in the atmosphere which act to start condensation at less than 100% relative humidity, and more heat is required to eliminate a visible plume if condensation begins at humidities below the theoretical relative humidity at which the plume is expected to form. Plume thickness cannot be predicted because the mechanism of mixing is an unsteady state process, depending upon the size of the droplet and lighting conditions. The enthalpy or heat content of the flue gas-air mixture is the sum of their individual enthalpies, which determines the temperature of the mixture. Water content or absolute humility of the mixture is determined by the individual contributions of the air and flue gas mixture. Formation of exhaust plume is avoided regardless of the mixture ratio between the flue gases and the outside air prior to the time that the flue gases are introduced to the atmosphere.

2758 APTIC NUMBER 20281

Roth, James F.
PROCESS FOR CATALYTICALLY TREATING EXHAUST GASES. (Monsanto Co., St. Louis, Mo.) U. S. Pat. 3,493,325. 5p., Feb. 3, 1970. 8 refs. (Appl. Sept. 12, 1967, 16 claims).

A process for the catalytic oxidation of exhaust gases from an internal combustion engine is described. The process involves passing the exhaust, in the absence of secondary air, over a degradative-resistant catalyst which is capable of reducing nitrogen oxides. The exhaust is then passed, in the presence of secondary air, over a catalyst which oxidizes carbon monoxide and hydrocarbons. The recommended catalyst is an alumina supported metal oxide.

2759 APTIC NUMBER 20369

Rothe, Wilfried
PROCESS FOR DESULFURIZING AND DEODORIZING HYDROCARBONS, ESPECIALLY HYDROCARBON OILS. (Deutsche Gold- und Silber-Scheideanstalt vormals Roessler (West Germany)) U. S. Pat. 3,496,098. 2p., Feb. 17, 1970. 4 refs. (Appl. Feb. 21, 1967, 5 claims).

Carriers which improve the desulfurizing and deodorizing action of sodium compounds used to treat hydrocarbon vapors are presented. The carriers are mixtures of carbon, preferably graphite, and an alkaline earth metal, preferably calcium oxide; the ratio of oxide to carbon is between 1:0.2 and 1:5 by weight. The carriers are intimately mixed with sodium monoxide or sodium hydride in the form of spheres, cylinders, tablets, and the like by compression molding or extrusion. Because the desulfurizing composition has high heat conductivity, heat accumulations in the reactor bed are avoided and the ability of the alkaline earth metal oxide to absorb sulfur is fully utilized. In addition, the desulfurizing compositions do not sinter during the reaction condition to such an extent that they are impermeable to the hydrocarbon vapors. The hydrocarbons to be purified are passed over the catalysts at 150 to 300 C, whereby all types of organic sulfur compounds are removed.

2760 APTIC NUMBER 20276

Rue, Phillip G. La
ELECTRIC SMOKELESS AND ODORLESS INCINERATOR. (Calcinator Corp.,

Bay City, Mich.) U. S. Pat. 3,496,890. 6p., Feb. 24, 1970. 4 refs. (Appl. Nov. 6, 1967, 9 claims).

A smokeless and odorless incinerator for burning garbage and other refuse is described. The refuse is placed in a primary combustion chamber where it is ignited by mounted heating elements. An afterburner is provided which returns the smoke and gases as they flow from the primary chamber. The remaining unburned refuse in the primary chamber is dried up by a second heating device before being burned. The heating elements may be open coil resistance wires which are protected by a grid placed between them and the refuse. The second heating device is preferably placed from the bottom of the primary chamber. (Author abstract modified)

2761 APTIC NUMBER 21299

Rueb, Friedmund
DUST EXTRACTION DURING PREPARATION OF ROAD CONSTRUCTION MATERIAL. (Entstaubung bei der Aufbereitung von Strassenbaustoffen). Text in German. Wasser Luft Betrieb, 14(4):138-141, April 1970. 2 refs.

For removing dust from drying drums used in the preparation of bituminous highway construction material, cloth filters are primarily used because of their high efficiency for fine particles. Either bag-type or envelope-type cloth filters are used. Synthetic felt is frequently used as filter material and is capable of operating with temperatures between 220 and 230 C. Peak temperatures around 270 C are permissible for short periods of time. The cloth filters are preceded by a cyclone for collecting the coarse particles (above 90 micron). A ventilator is usually installed after the dust separators to reduce wear and tear. As a consequence, the entire dust removal plant is operated at a slight underpressure. The combustion of a dry and wet collector also yields an effective dust removal system for mobile as well as stationary plants. The venturi scrubber has the advantage of rapidly cooling the gas temperature. The purified water from these scrubbers can be recirculated.

2762 APTIC NUMBER 21430

Rueb, Friedmund
SECOND CONGRESS AND EXHIBTION MAINTENANCE OF CLEAN AIR. (2. Kongress und Ausstellung 'Reinhaltung der Luft'). Text in German. Chem. Z./Chem. App., 94(6):203-206, 1970.

At the exhibition titled 'Maintainance of Clean Air', held in Duesseldorf October 13-17, 1969, 133 firms participated, 24 of which came from abroad. All familiar types of collectors such as cyclones, multicyclones, bag filters, scrubbers, and electrostatic precipitators were shown. Of the latter units, a precipitator with a magnetic hammer for removing the dust from the collection electrodes received special attention. A fully automatic, continuously operating cloth filter with rotating nozzle system for literating the bags from the collected dust was displayed. With the 'Turbex' scrubber, the dust-laden air enters laterally and rises through a perforated synthetic plate and a turbulent water foam zone. A new envelope type cloth filter consists of rotary envelopes of which one or more are inclosed in a chamber. Each envelope can be separately replaced.

2763 APTIC NUMBER 20456

Rumpf, Hans, Klaus Borho, and Hans Reichert
OPTIMUM CYCLONE DIMENSIONS CALCULATED BY MEANS OF SIMPLIFYING MODELS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(7):10-12, July 1969. 2 refs.

Cyclones are designed according to the desired separating limit and the required power consumption. A simplified method of determining these quantities and designing an optimum cyclone are based on an exponential equation describing the circumferential fluid velocity at the apex of the lower cyclone section. A dimensional separation limit is introduced to characterize the separation effected by a cyclone, as well as the energy loss coefficient related to the mean velocity in the dip pipe. The calculation results are displayed in diagram form.

2764 APTIC NUMBER 21255

Rushton, Don W. and Wendell Hays
SELECTIVE ADSORPTION TO REMOVE H2S. Oil Gas J., vol. 59:102-103, Sept. 18, 1961. 1 ref.

Natural-gas streams high in carbon dioxide content and with hydrogen sulfide content up to about 3% are good candidates for dry-bed selective adsorption using calcium alumino silicate. In order to apply this system economically, the CO2/H2S ratio should be greater than 3:1, thereby making questionable the economic use of conventional amine equipment. The system closely resembles the open-cycle type of dry-desiccant hydrocarbon-recovery plants, the prime difference being control of regeneration gas flow. Operating data and design considerations are included.

2765 APTIC NUMBER 21012

Russell, Sid
CATALYTIC BURNER. (United Aircraft Corp., East Hartford, Conn.) U. S. Pat. 3,490,878. 3p., Jan. 20, 1970. 2 refs. (Appl. April 28, 1965, 7 claims).

Apparatus for carrying out catalytic oxidation of gases is described, particularly for removing carbon monoxide that is metabolically generated by the exhalation of occupants of an enclosed compartment, such as a space vehicle. A heat transfer tube is helically wound around the catalytic bed and is sandwiched between an insulation lining the wall of the container and a cylindrical insulating shell spaced from it. The catalytic bed may contain suitable metal oxides such as manganese dioxide or

precious metal catalysts, of which rhodium metal on alumina is particularly efficacious. The gas to be reacted is admitted through the helically wound tube which directs the gas from the bottom of the container through the bed where it is turned 180 deg and returned back to the bottom between an annular space between the bed and the cylindrical shell. Gases emitted from the space defined from the heating cylinder and the inner shell are placed in indirect heat exchange relationship with the gases entering the catalytic burner as they are passing through the helical coils. (Author abstract modified)

2766 APTIC NUMBER 21220

Rutherford, J. G.
ENVIRONMENTAL CONTROL AT INCO UNDERGROUND DIESEL OPERATIONS. Can. Mining J., 89(10):54-58, Oct. 1968.

The 88 diesel-powered engines in service at 10 underground mines in Sudbury, Ontario, include load-haul machines, locomotives, drill jumbos, secondary drill tractors, service tractors, and a jeep. The methods employed to ensure proper engine fuel-to-air ratios, to eliminate toxic combustion products, and to provide adequate ventilation in diesel operating areas are described. To maintain clean burning engines, the oil in each intake air cleaner is periodically changed on site and the entire cleaner unit is completely cleaned once every two or three months. Oxy-catalytic scrubbers on diesel engine exhaust convert approximately 96% of the carbon monoxide to carbon dioxide. Similarly, hydrogen is converted to water vapor; aldehydes are almost completely removed; solid carbon, tars, and unburnt oil are oxidized to carbon dioxide, thus eliminating the smoke and smell associated with internal combustion engines. Since nitrogen dioxide is not affected by the oxidation process, adequate ventilation is required to dilute and ventilate this gas. Special mechanical ventilation systems are provided at all diesel development operations and at all ore extraction operations not directly ventilated by a main surface fan. Both electric and compressed-air fans are used for auxiliary ventilation. These procedures are augmented by weekly tests and volume surveys at each machine.

2767 APTIC NUMBER 20284

Sackett, Walter J.
DUST-FUME CONTROL SYSTEM. (Assignee not given.) U. S. Pat. 3,494,107. 3p., Feb. 10, 1970. 18 refs. (Appl. July 25, 1967, 7 claims).

A combined wet and dry separation system for cleansing process-evolved vapors, especially those from chemical fertilizer plants, is described. A series of dry cyclones remove a substantial portion of the dust particles from a gas stream. An impingement scrubber entraps any remaining dust particles, and removes some of the fumes. A tangential wet wall scrubber removes any residual dust and fume from the gas coming from the impingement separator. A conduit is constructed and arranged in the impingement scrubber to convey a portion of the slurry to an acid recovery plant. (Author abstract modified)

2768 APTIC NUMBER 20293

Sackett, Walter J.
HIGH EFFICIENCY DISCHARGE CONTROL SYSTEM FOR A CHEMICAL PROCESSING PLANT. (Assignee not given.) U. S. Pat. 3,499,731. 3p., March 10, 1970. 4 refs. (Appl. Feb. 16, 1967, 3 claims).

A fully implemented control system for preventing the discharge of obnoxious wastes from ammonium phosphate fertilizer plants is described. The ammoniator-granulator emits water soluble fumes, vapors, and particles; the dryer emits combustion dusts and vapors; and the cooler emits product dust and water soluble fumes. The problem of the wastes being of different vapors and dusts in differing combinations is solved by the use of regenerating combinations of dry and wet cyclones and scrubbers, taking into account that certain effluents are at elevated temperatures. (Author abstract modified)

2769 APTIC NUMBER 20671

Sare, Carl R.
DUST COLLECTOR. (Sly (W. W.) Manufacturing Co., Inc., Cleveland, Ohio) U. S. Pat. 3,490,207. 6p., Jan. 20, 1970. 26 refs. (Appl. July 14, 1966, 4 claims).

Dust collecting apparatus is described which includes a dust chamber with a dust wall mounted therein, a plurality of filter bags, and a reverse air flow traveler mechanism for selectively cleaning each bag. To dislodge the dust, a cleaning action may be effected by reverse air caused to flow through the fabric bags in a direction opposite the direction of flow of the dust-laden air entering the collector. The dust dislodged from the exterior surface of the bags may then be discharged into a hopper and removed from the system. In operation, the traveler moves progressively along the open ends of the bags in a manner to direct a reverse air flow into the bag to be cleaned. Flexible rollers overlap one or more of the bags on either side of the bag to be cleaned, thereby sealing off the bag being cleaned from the adjacent bags so as to direct the reverse air flow only into the bag which is directly opposite the reverse air nozzle.

2770 APTIC NUMBER 20709

Sato, S.
DISPOSAL OF ODOR IN FERTILIZER INDUSTRIES. (Keifun kansoko jo no akushuqasu no shori ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):71, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The exhaust gas from the dryer for fertilizer manufacturing in a chicken farm is a severe pollution problem due to its extremely obnoxious odor. Most dryers fall into the rotary kiln category, to which the discussion is limited. Among various ways of removing the odor, for a farm with the capacity less than ten

thousand chickens, the process of passing the gas through earth, particularly from agricultural land, is effective, apparently due to the action of bacteria and physical adsorption. For larger farms, the purification method using alkali solution is more useful, and the process was actually employed in a farm with three dryers, each with a capacity for ten thousand chickens. A nearby stream of pH 3-4 was used with 1% alkali solution in order to eliminate the odor and was found to be very effective.

2771 APTIC NUMBER 21209

Sauermann, Werner
FILTER STRUCTURE. (Standard Filtervau-G.m.b.H., Munster (West Germany)) U. S. Pat. 3,478,498. 4p., Nov. 18, 1969. 13 refs. (Appl. Dec. 13, 1967, 14 claims).

In the filtration of gaseous fluids which are contaminated with dust particles, particularly at high temperatures, filter elements have been used consisting of a layer of heat resistant mineral fibers sandwiched between two layers of wire mesh. It has not been possible to stiffen and compress the fibrous material in order to prevent undesirably deep penetration of dust particles and analogous impurities and to assure that these are retained at the filter element surface. A pocket-type filter structure is described wherein the layer of fibrous filter material is stiffened and compressed without damage to its integrity, while a method is provided for securing the filtering element to its supporting frame in such a manner as to effect a fluid-tight connection. The filter element has two opposite sides and includes two apertured supporting layers and a filter element of fibrous filter material which is sandwiched between the supporting layers. Reinforcement apparatus engage one side of the filter element at a plurality of spaced first locations for the purpose of supporting the filter element at this one side. A plurality of deflecting bars engage the outer surfaces of the filter element intermediate the reinforcing bars and deflect the filter element intermediate the reinforcing bars inwardly into the chamber.

2772 APTIC NUMBER 20481

Schell, T. W.
CYCLONE/SCRUBBER SYSTEM QUICKLY ELIMINATES DUST PROBLEM. Rock Prod., 71(7):66-68, July 1968.

A company which manufactures asphalt for roads in Lancaster, Pa., and nearby Denver, faced a directive by the Pennsylvania Air Pollution Commission to meet new dust emission standards. Results of testing showed that dust emissions amounted to more than 225 pounds per hour, or 2.9 wt.% of particles larger than 10 micron. Two scrubber plants were installed in May and June 1967; the installation of each took only 18 hours. The amount of gas introduced to the cyclones is about 22,000 cfm and is at a temperature of 180 F for the cyclones and 155 F for the scrubber proper. About 92% of all fine rock dust is collected, while the remainder of the particulate is cleaned with an efficiency of 98.66%, with an overall gas cleaning efficiency from all collectors of 99.88%.

2773 APTIC NUMBER 21697

Schiele, Gerhard
FINAL COLLECTION OF CARBON BLACK FROM GASES PRODUCED BY LOW-PRESSURE CRACKING OF LIQUID AND GASEOUS HYDROCARBONS BY MEANS OF ELECTRO-PRECIPITATORS. (Feinstentrussung von Gasen aus der drucklosen Spaltung von fluessigen und gasfoermigen Kohlenwasserstoffen durch Elektrofilter). Text in German. Erdoel Kohle (Hamburg), 23(5):284-286, May 1970. 5 refs.

An electrostatic precipitator was first used in 1958 for removal of the soot particles in low-pressure cracked methane. The gas underwent preliminary cleaning in a scrubber, and then was passed through an electrostatic precipitator. At a gas throughput of 3,000 cu m/h, the residual soot content could be brought down to less than 1 mg/cu m. A soot cleaning system in a methane cracking station is illustrated and explained. The scrubber is divided into one section in which the gas is cooled to 55 C, its soot content reduced to between 0.8 and 1.8 g/cu m, before the gas is supersaturated with water and cleaned in the electrostatic precipitator. In the second section of the scrubber the cleaned cracking gas is cooled to 30 C. In oil cracking plants it is necessary to operate two electrostatic precipitators alternately since additional cleaning of the electrodes is required.

2774 APTIC NUMBER 21316

Schmitz, P.
THEORY AND PRACTICE OF DUST SEPARATION PROCESSES. (Zur Theorie und Praxis von Entstaubungsvorgaenge). Text in German. VID (Ver. Deut. Ingr.) Ber., no. 149:237-243, 1970.

Mechanical dust separators remove the dust from the gas flow through the effect of gravity, inertia, or centrifugal force. Of all the dust separators belonging to this group, cyclones are the only ones suitable for separating the frequently occurring fine dusts. Separation is determined in these units by the tangential flow in the vicinity of the wall and by the radial secondary flow. The latter increases as it approaches the top of the cyclone, while wall friction increases with the third potency of the distance from the cyclone top. With the aid of a mathematical model, the optimum cyclone can be found for the various parameters introduced into the calculation. Apart from the cyclone with gas deflection, another type has come into wide use where an adequately directed secondary gas flow is used to accelerate the particles. Comparison of the efficiency of the two cyclones revealed that all particles above 3 micron are more efficiently separated in the first type, and those with about 1 micron in the second type. The separating process in wet collectors, too, is achieved through centrifugal force acting on the particles which have been enlarged by the adhering particles of the scrubbing fluid so that a joint separation is affected. In electrostatic precipitators, the solid particles are separated from the gas by electric forces after they have been ionized. The electric dust resistance is of decisive importance for efficient separation.

2775 APTIC NUMBER 20608

Schnabel, J. W., J. E. Yingst, C. M. Heinen, and W. S. Pagley
DEVELOPMENT OF FLAME TYPE AFTERBURNER. Preprint, Society of Automotive Engineers, Inc., New York, 14p., 1962. 12 refs. (Presented at the National Automobile Week Congress, Detroit, Mich., March 12-16, 1962, Paper 486 G.)

The feasibility of oxidizing the exhaust gas of a spark-ignition engine in a high temperature flame afterburner was evaluated theoretically and experimentally. The theoretical considerations indicated that flame-type afterburners are possible only if a narrow range of exhaust gas composition is maintained and that combustion can be self-sustaining only with the addition of supplementary fuel or sensible heat. Minimum use of supplementary fuel can be achieved through the use of a heat exchanger which takes advantage of the temperature of combustion to preheat the gas entering the reaction. The location of the afterburner is of prime importance, since this determines in part the temperature entering the unit. Four types of afterburners were built and tested on V-8 installations: core-type, matrix type, manifold, and regenerative. Both recuperative and regenerative heat exchangers in several different forms were used. The regenerative type afterburner lowered emissions to values well below those specified in the California Standards. The penalties in performance and economy, while noticeable, were not unreasonable. However, substantial development work must be done on materials and on electrical and mechanical components before the regenerative units can be considered commercially feasible. Data are presented showing the performance of regenerative afterburners located near the engine and in the muffler position. Other data illustrate graphically the realtionships between the various parameters affecting the reaction and the effect of these relationships on heat exchanger design.

2776 APTIC NUMBER 20639

Schrag, Wolf
INTERNAL COMBUSTION ENGINE AFTERBURNER AND AIR SUPPLY SYSTEM. (Firma Dr. Ing. H. c. F. Porsche KG, Stuttgart-Zuffenhausen (West Germany)) U. S. Pat. 3,491,533. 4p., Jan. 27, 1970. 5 refs. (Appl. Sept. 12, 1967, 8 claims.)

Known afterburner arrangements for internal combustion engines employ a pump or blower to supply secondary air to the exhaust conduit and a filter at the suction side of the blower to treat both combustion and secondary air. Because of construction difficulties, this provision causes engine costs to increase. To avoid these disadvantages, the present invention connects the suction side of the blower 'in shunt' to the clean air chamber of the air filter for the combustion air. A separate filter arrangement for secondary air is thus avoided. At the same time, the suction noises of the blower are subdued by the air filter of the combustion air so the noise level of the engine is not increased by the addition of an afterburner. The air filter and blower are combined into a single rigid unit; the supply of secondary clean air is accomplished through a tube extending concentrically through the air filter and by an intermediate passageway in the support bracket used to mount the blower-air filter unit. This obtains a closed suction system in which freely extending suction pipes are avoided. The air filter is tightly secured to the support bracket by a tension bolt extending through the air guide tube. The blower is a gear blower driven from the engine crankshaft through a power train and rigidly connected directly to the support bracket.

2777 APTIC NUMBER 21263

Schroeter, K.
SEPARATION OF FINE DUSTS IN HORIZONTAL FLUE GAS ELECTROSTATIC FILTERS. (Zur Abscheidung feiner Staeube in Horizontal-Rauchgaselektrofiltern). Text in German. Energietechnik, 20(4):164-68, April 1970. 10 refs.

Specific particle surface, which is a function of the particle size distribution, determines the dust particles in an electrostatic precipitator. Large specific surfaces cause corona suppression, with particle ionization consequently impaired and the collection efficiency reduced. For fine fly ash from a slag furnance, and coarse duts from a pulverized coal-fired boiler, the critical filter length is graphically determined. It is obtained from the critical dust concentration, the number of existing charge carriers sufficient for particle ionization. For the coarse ash, the critical filter length is in all cases below 1 m; for the fine ash the critical dust concentration is not reached at the available lengths of the precipitator. The collection efficiency can be improved for fine dust by installing spray point electrodes in the critical filter zone, by using low gas speeds, narrow plate distances, and separating the plates electrically into three zones and by using efficient rapping devices.

2778 APTIC NUMBER 21116

Schuetz, H.
HINTS ON THE SELECTION OF THE MOST SUITABLE DUST EXTRACTOR. (Hinweise zur Auswahl des geeignetsten Entstaubers). Text in German. Keram. Z., 20(8):489-490, 1968.

Dust collection is easy if the grain particles are of the same size; it becomes problematic and requires complex systems, sometimes two or more stages, if the sizes range from a fine aerosol to coarse particles. The greater the quantity of dust in the air stream, the better the collection efficiency. The dust concentration, grain size, and type of dust determine the wear and tear of a collector. Certain dusts tend to become encrusted in the collector. Fine, dry organic dust particles may cause an explosion or a fire. Corrosion may frequently be averted by applying a coating to the collector surfaces; it is frequently encountered with wet collectors. The temperature resistance of many dust separators is limited. Bag filters of synthetic fiber (Orlon) cannot withstand temperatures higher than 120 C. Siliconized glass fiber filters can withstand temperatures between

250 to 270 C. All collectors require maintainance.

2779 APTIC NUMBER 20692

Schwab, Louis
FILTER ASSEMBLAGE FOR PURIFYING A PARTICLE-LADEN GASEOUS FLOW. (Assignee not given.) U. S. Pat. 3,474,599. 6p., Oct. 28, 1969. 18 refs. (Appl. Jan 4, 1968, 8 claims).

A flat-type filter assemblage for separating solid particles from a gaseous flow is described that achieves a much larger effective filter area than any known flat filters. This is accomplished by mounting soft, pleated fiber material across the rim of one side of an open-ended frame and securing the overhanging filter material to the outside of the frame walls. An air flow directed at the upstream side of the filter partly inflates the pleats, thus increasing the total available filter area and causing the air flow to utilize the entire area rather than to leave pockets of heavily clogged areas and pockets of still comparatively clean areas. The filter assemblage can be inserted in a carrier frame for installment in an air duct. However, it is generally preferable to cover the outside walls of the frame with a suitable pliable material such as a rubberized fabric. Since the filter is inexpensive to manufacture, it is economic to discard the entire assemblage after the filter has become clogged.

2780 APTIC NUMBER 21206

Schwartz, Irvin
ENVIRONMENTAL CONTROL. Chem. Week, 106(24):79-86, June 17, 1970.

Methods and costs of air pollution control are reviewed with emphasis on the efforts of the chemical processing industry. The magnitude of the task is shown by Public Health Service estimates of the amount of pollutants poured into the atmosphere each year: particulates, 15 million tons; sulfur oxides, 30 million tons; hydrocarbons, 24 million tons; carbon monoxide, 87 million tons; nitrous oxides, 17 million tons. Within the chemical processing industry, the percentage of capital outlay for air pollution control equipment is expected to remain constant, but the kind of equipment is expected to change. Expenditures for particulate controls account for more than one-third of industry expenditures. Gaseous emission controls, currently less than 2% of sales, is expected to jump to 40% following development of Federal gaseous emission criteria. The Health, Education, and Welfare Dept. guidelines for air quality criteria issued to date are listed. The cost of compliance with the HEW 'suggestions' are estimated. For the sulfuric acid industry, this estimate is $26-39 million capital expenditure and $1.5-2.8 million/year operating cost. For the phosphate fertilizer industry, the estimates are $3.1-6.7 million and $1.3-2.7 million. The four basic means of collecting particulates, fabric filter, electrostatic precipitator, cyclones, and scrubber are described, along with their capabilities and cost. The three basic systems for gaseous emission control, scrubbing, adsorption, and incineration are similarly treated. By-product recovery is evaluated as a means of reducing the effective cost of air pollution control. In contradiction to the National Research Council-National Academy of Engineering's statement 'commercially proven technology for control of sulfur oxides from combustion processes does not exist', half-a-dozen sulfur oxide-sulfuric acid conversion processes are listed.

2781 APTIC NUMBER 20764

Schwing, Richard C.
ELECTROSTATIC CLEANER APPLICATION. (General Motors Corp., Detroit, Mich.) U. S. Pat. 3,475,917. 3p., Nov. 4, 1969. 4 refs. (Appl. June 17, 1968, 4 claims).

The capillary deposition of particles at the outlets of various types of flow restricting devices in refrigerant systems gradually reduces the ability of the refrigerant system to produce cold. To reduce deposition, the refrigerant circuit is provided with an electrostatic precipitator located at the entrance of a capillary restrictor, thereby causing the precipitation of particles from the refrigerant prior to their entrance into the restrictor. Preferably the capillary restrictor tube is electrically isolated in the circuit and the streaming potential generated therein by the flow of the refrigerant is used to power the electrostatic precipitator. (Author abstract modified)

2782 APTIC NUMBER 20365

Scott, Calvin Lee
PNEUMATIC CONVEYOR AND DUST SEPARATOR SYSTEMS. (Assignee not given.) U. S. Pat. 3,498,660. 7p., Feb. 10, 1970. 12 refs. (Appl. Feb. 14, 1968, 6 claims).

Reverse flow, air jet, or vibrator techniques for cleaning filters in existing pneumatic conveyors and dust separator systems increase initial cost, decrease reliability, and lower operating efficiency. The pneumatic conveyor system described effectively separates large particles and dust from air by utilizing compartmentalized hoppers and airflow passages to provide for the self-cleansing of filters. No additional energy is required. Flexible filters, with a triangular cross-sectional configuration, are removably mounted by frames in the two compartments of the first hopper. Weighting elements are secured to the mid-regions or apexes of the filters. When airflow through the filters is alternately interrupted by the application of a direct airflow, the weighting elements fall rapidly under the influence of gravity to alternately jolt and cleanse the filters. To separate large particles, such as grain, a compartmented second hopper communicates with the inlet conduit of the first hopper and includes a screen across each compartment through which the air is alternately directed.

2783 APTIC NUMBER 20550

Seidl, W.
DESULFURIZATION OF WASTE GASES, A CENTRAL PROBLEM OF AIR HYGIENE. (Entschwefelung von Abgasen, ein zentrales Problem der

Lufthygiene). Text in German. Brennstoff-Waerme-Kraft, 20(3): 129-131, March 1968. (Report on two symposia of the VDI Commission on the Maintainance of Clean Air, June 2, 1967, Duesseldorf, and Oct. 24-26, 1967, Munich.)

Munich has temperature inversions on 285 days of the year; the city is almost always in a haze. To avoid large-scale air pollution episodes, city authorities determined the wind direction and speed, and measured the dust fall and sulfur dioxide concentration of the atmosphere. In order to reduce emissions, the city plans to extend the central heating system over the entire city (now 20% of the households are remotely heated). According to all available knowledge, SO2 removal from waste gases involves a good deal of money. None of the presently available methods are economical. Both Reinluft and Sulfacid processes adsorb SO2, O2, and H2O on coke. They differ, however, as far as desorption and regeneration is concerned. In the Reinluft process, SO2 is liberated thermally; in the Sulfacid process, it is scrubbed out. Sulfur can be also removed by binding it to alkaline dusts or aqueous dust suspensions which are added to the coal or injected into the combustion chamber. The Grillo desulfurization method can be used for the removal of sulfur dioxide, sulfur trioxide, hydrogen sulfide, and mercaptans. The Mitsubishi, Monsanto-Penelec processes and the method developed by the Bureau of Mines are briefly outlined. The latter process uses alkalized alumina to bind the SO2.

2784 APTIC NUMBER 21291

Seidl, Walter
DESULFURIZATION OF WASTE GASES AND FUEL. (Entschwefelung von Abgasen und Brennstoffen). Text in German. Brennstoff-Waerme-Kraft, 22(4):174-180, April 1970. 220 refs.

Daily average sulfur dioxide concentrations of more than 300 micrograms/cu m (0.11 ppm) for three or four days many affect human health. The same is true for long-term exposure to annual average concentrations above 0.04 ppm. Material begins to deteriorate at 0.12 ppm annual average. Plant damage appears at 0.03 ppm annual average. The Continuous Air Monitoring Project in the U. S. yielded annual average concentrations of 0.07 ppm for San Francisco and 0.18 ppm for Chicago. In 1966, 28.6 million tons of SO2 were emitted in the U. S. A list of existing desulfurization methods for waste gases is given, beginning with those used in the U. S. The most important processes enumerated are as follows: the dry lime/dolomite process by TVA; the C-E process; the alakalized alumina process; the Monsanto-Penelec process; and the Beckwell process. For the Federal Republic of Germany, the following processes are used: the Wikkert process; Bischoff-,Reinluft-, and Grillo-AGS-processes; and the sulfacid process. For Japan, the Hitachi, Mitsubishi, and Kiyoura processes are named. Numerous bibliographic references are given for each process. The Electricite de France scrubs flue gases in NH4OH-solution. In Austria, the Stickstoffwerke Linz absorb SO2 in ammonium sulfite-bisulfite-solution. All fuel desulfurization processes are presented in a similar way. No description of any of the processes is given. Gasification of coal is specifically mentioned. Plants for the removal of sulfur from mineral oil are being installed on the East Coast of the U. S. they will have capacities of 5 million tons/year and will reduce the sulfur content to less than 1%. The Consolidated Edison Co. switched to oil with less than 1% S as fuel and to natural gas.

2785 APTIC NUMBER 20329

Seki, Taneyuki
REMOVAL OF SULFUR DIOXIDE FROM FLUE GAS. (Endohaigasu chu no aryusangasu jokyo). Text in Japanese. Nenryo Oyobi Nensyo (Fuel and Combustion, 38(8):764-772, Aug. 1, 1969.

After world War II, crude petroleum became the important source of energy, leading to the pollution of air by sulfur dioxide. The popular method of fuel oil desulfurization is the indirect hydrogenation process; but, as the control of SO2 is intensified, the tendency is to move to the more expense but more effective direct desulfurizaiton or to combine the two methods. In Japan, the following desulurization methods are under development: active MnOx, active carbon, contact oxidation, CaO injection, active Na2CO3, wet NH3, and wet absorbing methods. In America, where coal is more important the following desulfurization methods were developed: CaO dolomite injection, alkalized Al2O3, and active oxidation methods. In Europe, there seems to be no efficient methods. Final considerations are a problem for any, but both the desulfurization of petroleum and desulfurization of exhaust gas are deemed necessary. Since the control of SO2 will be intensified, a more efficient method of desulurization is expected.

2786 APTIC NUMBER 20766

Setzer, Herbert J. and Richard W. Whiting
SULFUR REMOVAL FROM HYDROCARBONS. (United Aircraft Corp., East Hartford, Conn.) U. S. Pat. 3,485,746. 6p., Dec. 23, 1969. 4 refs. (Appl. Sept. 26, 1967, 2 claims).

A process is described whereby residual sulfur is removed from hydrocarbon fuels containing from 200-500 ppm sulfur in a single step by contact with finely divided nickel at an elevated temperature in the presence of steam. It finds particular application in fuel cell systems, where even trace amounts of sulfur can degrade the reformer and fuel cell catalyst. Prior to admission to the reformer, the hydrocarbons is vaporized and mixed with steam in a ratio of about 2-5 moles of steam per mole of carbon in the hydrocarbon, then passed through a reactant-adsorbent granular bed supported on an inert carrier at 500-900 F. (Sulfur and sulfur-containing compounds are adsorbed while preventing substantial cracking of the hydrocarbon.) Hydrogen is added to the vaporized hydrocarbon-steam admitted to the reactant-adsorbent bed in a ratio of about 0.02-0.1 lbs of hydrogen per lb of hydrocarbon. The hydrocarbon is next passed through the reformer catalyst to convert a substantial portion of the hydrocarbon to hydrogen and carbon oxides before admittance to the fuel cell.

2787 APTIC NUMBER 20485

Shale, C. C., W. S. Rowie, J. H. Holden, and G. H. Strimbeck
FEASIBILITY OF ELECTRICAL PRECIPITATION AT HIGH TEMPERATURES AND PRESSURES. Bureau of Mines, Washington, D. C., Dept. of Investigations 6325, 20p., 1963. 15 refs.

The electrical characteristics of air in a 2-in. pipe-type electrostatic precipitator under dynamic conditions at 600-1500 F and 0-80 psig using a negative discharge electrode were studied for potential application to new processes for utilizing coal. These applications include removal of entrained fly ash from the products of combustion from coal-fired boilers to allow direct use of the hot pressurized gases to power a gas turbine, and removal of carbonaceous residue from synthesis gas made from coal in order to permit use of the sensible heat in the gas. Results of this one-geometry study show that current-voltage relationships are a function of air pressure and temperature through about 1350 F over the full range of pressure. Corona starting voltage and sparkover voltage vary directly with pressure and inversely with temperature. At temperatures above 1350 F, use of precipitators may be limited to operations at pressures somewhat above atmospheric pressure. Theoretical derivations are presented that relate the effect of gas density on corona starting voltage and the effect of ion mobility on corona current. Deviation from the theory is noted at high current levels. Theoretical discussion is presented to explain the apparent electrical limitations for use of precipitators at high temperature, low gas density, and high corona currents, conditions at which calculated ionic velocities are extremely high. Experimental results are interpreted in terms of the theory presented. At 1500 F, thermal ionization does not appear to be a certain factor. (Author abstract modified)

2788 APTIC NUMBER 20677

Shale, Correll C.
PROCESS FOR ELECTROSTATIC PRECIPITATION. (United States of America) U. S. Pat. 3,482,374. 5p., Dec. 1969. 14 refs. (Appl. Oct. 3, 1967, 4 claims).

Electrostatic precipitation of particulate matter from gas streams above about 1200 F and at low to intermediate pressures accomplished by providing a collecting electrode to emitting electrode effective diameter ratio of less than about 50. An outer collecting electrode, preferably comprising an elongated hollow cylinder and provided with a gas entry port and a clean gas exit port, is held at ground potential by any suitable grounding means. This electrode is flanged at top and bottom and connected to a cathode entry chamber and a dust particle collection chamber. While it is not necessary to the operation of the precipitator to provide cooling for the cathode entry and particle collection chambers, such a provision allows greater flexibility in construction and operation of the device. Disposed within and coaxial to the outer positive collecting electrode is the cathode, which is preferably a circular wire of such size as to provide a diameter ratio of the collecting electrode to the emitting electrode of less than about 50. Thus, in a cathode consisting of a rectangular, triangular or other geometric shape, the effective diameter is defined by the radii of curvature making up the corners of those geometric shapes. The cathode is supported and centered within the collecting electrode by means of an insulator, preferably constructed of porcelain.

2789 APTIC NUMBER 21494

Sheahan, T. J., C. J. Dorer, Jr., and C. O. Miller
DETERGENT-DISPERSANT FUEL PERFORMANCE AND HANDLING. Preprint, Society of Automotive Engineers, Inc., New York, 21p., 1969. 15 refs. (Presented at the Society of Automotive Engineers, Mid-Year Meeting, Chicago, Ill., May 19-23, 1969, Paper 690516.)

Detergent-dispersant gasoline additives have been shown to be superior carburetor detergents on both 'cleanup' and 'keep clean' cycles. In addition, they supply an added increment of dispersancy to crankcase lubricants, thereby providing increased overall engine and PCV valve cleanliness. When used at 35 lbs per 1000 barrels, detergent-dispersant gasoline additives keep intake valve deposits soft and pliable so that there is less tendency for hard fragments to break off and cause engine malfunctions. At use levels of 70 lbs per 1000 barrels and higher, the deposits are substantially reduced in both laboratory and field tests. A series of bench scale tests are reviewed whic compare a detergent-dispersant additive with a conventional detergent on emulsion formation and water and particulate matter separation. Results show equivalent properties in all tests except the water haze test where the dispersant requires a somewhat longer time to clear. (Author summary)

2790 APTIC NUMBER 21253

Shell, Allen D.
CONSIDER BASIC PROBLEMS IN IMPROVING MEA FILTRATION. Oil Gas J., 66(7):98-99, Feb. 12, 1968.

Filtration of monoethanolamine (MEA) solutions in gas processing and treating plants has lead to reduced corrosion, foaming, and fouling. Low costs provide little incentive for improving existing practices. Disposable-element-type filters are in widespread use. Inlet separators with demister pads can minimize the problem of hydrocarbon-liquid and corrosion inhibitor carryover into the MEA system. Diatomaceous-earth filtration is successful where well-treated compounds contaminate the MEA. Calculations to determine side-stream filtration rates are given. Iron sulfide is the most prevalent solid in MEA systems.

2791 APTIC NUMBER 21312

Siler, Klaus
PRESENT AND FUTURE DUST REMOVAL IN FOUNDRIES. (Stand und Perspektive der Staubbekaempfung im Industriezweig Giessereien). Text in German. Giessereitechnik, 16(3):80-83, 1970. 6 refs.

(Presented at the second meeting 'Combating of Dust', Leipzig, Oct. 9 and 10, 1969.)

At present, the dust developing at the various stations in foundries in East Germany is drawn off individually by fans or blowers. With progressing automatization, it is foreseen that central exhaust systems will be installed. Legal regulations determine that the sand be pneumatically transported, the sand treatment station be housed in a separate building, or that an underpressure be maintained if this is not feasible. The use of pressurized air for cleaning the molds is forbidden. The dust must be drawn off by exhaust fans. In the past few years, wet collectors have been frequently used for dust removal. Critical analysis, however, shows that in some cases (e.g. at large air quantities) dry collectors are preferred. The selection of the dust removal system suiting individual conditions is urged. It is predicted that electrostatic precipitators will gain greater importance in foundries because of the high collection efficiency for small particles. They will not become the universally used collector for foundries, however, because of the large space requirement and the high investment cost.

2792 APTIC NUMBER 20743

Simizu, Kiyosi
WET TYPE GAS SCRUBBER. (Yawata Iron and Steel Co., Ltd., Tokyo, Japan) U. S. Pat. 3,502,308. 3p., March 24, 1970. 4 refs. (Appl. May 29, 1968, 3 claims).

A venturi-type scrubber, in which the generation of unnecessary eddy currents in the gas flow produced or a blast furnace can be prevented, is described. A throttling part is situated above a throat part, and an inner tube having a flow passage area smaller than the cross-sectional area of the throat is provided. The inner tube comes into contact with the inner surface of the throttling part. When the inner tube is moved vertically in the same direction as the gas flow along the axis, the flow passage area in the throat may be varied to make the gas flow velocity constant. By using this type of scrubber, pressure loss can also be reduced. (Author abstract modified)

2793 APTIC NUMBER 20776

Smith, M. C. and A. A. Salerno
ENGINEERING FOR LOW SULFUR FUELS. Combustion, 41(11):6-12, May 1970. (Presented at the ASME Winter Annu. Meet. Energy Systems Expo., New York, 1968. Paper 68-WA/APC1.)

Engineering for low-sulfur fuels must recognize that low-sulfur ash has a higher resistivity making it more difficult for electrostatic precipitators to collect the ash. This problem is minimized by a 'hot side' precipitator arrangement that situates the precipitator between the boiler and an air heater, where the gas temperature is about 700 F. Another problem is that the wax within some low-sulfur oils, such as paraffin base crudes, tends to solidify out at much higher temperatures than ordinary oil. Thus the oil should be chosen with a pour point high enough to insure minimum viscosity and thereby prevent clogging of pumps. If the temperature of the oil going to the pumps is too high, the lower visosity of the oil could cause either increased wear of screw pumps or vapor lock; if the temperature is too low, the oil might not flow at all. To prevent high-pour point oil blockage it may be necessary to steam trace larger pipelines and pumps and to heat electrically smaller lines. Electric heating can be efficiently and economically accomplished with a heating cable, nylon ty-raps, and aluminum-clad copper connections.

2794 APTIC NUMBER 20620

Smith, Roger P.
COBALT SALTS: EFFECTS IN CYANIDE AND SULFIDE POISONING AND ON METHEMOGLOBINEMIA. Toxicol. Appl. Pharmacol., vol. 15:505-516, 1969. 24 refs. (Presented in part at the Society of Toxicology, Annual Meeting, 8th, Williamsburg, Va., 1969.)

Pretreatment of mice with cobaltous chloride protects them against a potentially lethal dose of sodium cyanide or sodium sulfide. The mechanism of this protective effect is unknown but is presumed to reflect a direct chemical reaction between cobalt and cyanide or sulfide. Methemoglobinemia was not observed after protective doses of cobaltous chloride in mice. Pretreatment of mice with sodium cobaltinitrite also protects them against potentially lethal doses of sodium cyanide or sulfide. At leat part of this protective mechanism, however, must be ascribed to methemoglobin formation by the injected cobaltinitrite. A comparison of cobaltinitrite-methemoglobinemia with that generated by sodium nitrite indicates that only 3 of the 6 equivalents of nitrite in each mole of cobaltinitrite are released under biological conditions to react with oxyhemoglobin. Comparison between in vivo and in vitro methemoglobinemias indicates that the major portion (75-80%) of injected sodium nitrite is apparently inactivated by processes other than reaction with oxyhemoglobin; the same is true of cobaltinitrite, but whether in vitro or in vivo, only 3 nitrite equivalents per mole are released. Thus, methemoglobin formation by cobaltinitrite accounts for less than half of the cyanide inactivated in pretreated mice. In the case of sodium sulfide, however, the entire protective effect can be accounted for on the basis of methemoglobin formation and subsequent trapping of the hydrosulfide ion. Cobaltinitrite blocks methylene blue stimulation of methemoglobin reductase activity in concentrations that do not produce excessive hemolysis, and this effect may be shared by cobaltous chloride, although it is observed only at concentrations that produce gross hemolysis. (Author abstract modified)

2795 APTIC NUMBER 20418

(Inventor not given.)
PROCEDURE AND APPARATUS FOR ELIMINATION AND RECOVERY OF SULFUR FROM INDUSTRIAL FLUE GASES. (Procede et dispositifs pour l'elimination et la recuperation du soufre dans les fumees industrielles). Text in French. (Societe Fives-Penhoet, Paris (France)) French Pat. 1,450,[illegible]. 5p., July 18, 1966. (Appl. Dec. 29, 1964, 19 claims.)

A procedure is presented for eliminating and recovering sulfur in industrial flue gases. The waste gases are treated at a moderate temperature by a catalyst capable of inducing oxidation of sulfur dioxide to sulfur trioxide and to fix the SO3 so obtained. The resulting products of fixation are dissociated by bringing them to a high temperature to regenerate the above-mentioned catalyst and to release SO3 for its recovery. The heat of the purified waste gases, augmented by the heats of formation and fixation of SO3, is recovered before these gases are discharged. The catalyst is of the metal-oxide type and, particularly, Fe2O3. The waste gases are treated at temperatures of 350 to 450 C. The fixation products are dissociated by a gas current at a high temperature which carries away the SO3 liberated for its recovery; this gas current is made up of a small fraction of the waste gases removed at a high temperature at the source of the waste gases. Alternatively, this gas current is provided by a source independent of the waste-gas source, and it has a temperature of 750 to 850 C. The SO3 carried away by the gas current is recovered by known procedures, preferably in the form of oleum; the heat of the gas current and, possibly, the heat of hydration of the SO3, are recovered before this gas current is discharged. An additional set of 9 claims refer to details of an apparatus in which the above procedure can be carried out.

2796 APTIC NUMBER 20289

Sokol, Frank
EXTENDED AREA AIR FILTER. (Johnson and Johnson, Corp., N. J.) U. S. Pat. 3,500,618. 4p., March 17, 1970. 9 refs. (Appl. June 7, 1968, 5 claims).

In order to improve the efficiency of the filtering systems used in air conditioning and heating systems, it is advantageous to increase filter capacity. An extended area air filter, comprising a pair of substantially co-extensive trapezoids of fibrous batts, is described. The batts are slit from the mid-point along their shorter parallel side, the slit being perpendicular to the parallel sides. They are secured together at both non-parallel edges and along both sides of the slit. Each batt is folded upon itself at the mid-point between the slit and the non-parallel edge along the shorter side, and sealed together at the shorter parallel side. This forms a pair of truncated ellipsoidal conical sections, collapsed and sealed at their top positions. (Author abstract modified)

2797 APTIC NUMBER 20520

Solbach, Werner
DERIVATION OF A COMPUTATIONAL METHOD FOR MULTICHAMBER CLOTH FILTERS ON THE BASIS OF EXPERIMENTAL RESULTS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(1):28-33, Jan. 1969. 3 refs.

A basic equation is derived for a multichamber cloth filter, which defines (for a constant pressure loss) the relationships between the gas flow rate and all parameters influencing this rate. Theoretical analysis was based upon data from a test device developed to simulate actual operating conditions; resistance of filter bags as a function of dust type, dust load, gas flow, and cleaning intensity was investigated with this apparatus. In the load range of interest, the ratio of pressure loss to gas flow was constant in accordance with the laminar resistance law, provided the state of the filter medium did not change. When evaluating results, the measured pressure losses were therefore invariably correlated with the specific resistance. In contrast with widely-held views, it appears that the absolute capacity of a fabric with regard to the gas flow rate is largely dependent upon the dust load; thus, the average gas flow from the respective dust loads of the fabric in each chamber can be chosen much higher for a filter with fewer chambers and low dust content of gases than for a filter with many chambers and high dust concentration. By using the equation, maximum load capacity and optimum design can be determined for specific industrial applications. A practical example of the use of the equation is worked out.

2798 APTIC NUMBER 21268

Spaite, Paul W. and Robert P. Hangebrauck
NEW SPELLS OUT AIR-QUALITY GOALS. Elec. World, 173(20):25-27, May 18, 1970.

About half of the air pollution from industrial and commercial activities is produced by the burning of coal, oil, and natural gas. The emissions originate in power plants, industrial boilers, and small installations used for commercial and residential heating. Power production, which accounts for 70% of the total sulfur oxides emissions from combustion, is the most important source. Power plants also account from 10% to 40% of all nitrogen oxides emissions. Particulate emissions appear to be less critical than SOx or NOx, but this may be misleading because particles less than 1 micron in size are not accounted for. Conventional electrostatic precipitators can reduce the emissions slightly, but the number of fine particles will increase by a factor of four between 1970 and 2000. Control of SOx emissions by flue-gas cleaning should soon be practicable. The 'throwaway' processes, which involve reacting SOx with limestone, to be collected as calcium-sulfur in precipitators or wet scrubbers, are most likely to find application. Reliable methods must be developed for controlling NOx emissions from boilers. Electrostatic precipitators could control much of the fly ash, but many of those operating today function inefficiently because they were designed for less stringent requirements or have lost efficiency. There is a critical need for improved systems and techniques for controlling submicron particles.

2799 APTIC NUMBER 21023

Spengler, G.
INTRODUCTION TO THE PROBLEM OF DESULFURIZATION OF WASTE GASES. (Einfuehrung zum Problem der Verminderung des Schwefelgehaltes in Abgasen). Text in German. VDI (Ver Deut. Ingr.) Ber., no. 149:93-97, 1970. 17 refs.

In West Germany 3.5 million tons of sulfur dioxide were emitted

into the air in 1967 and is estimated that this amount will go up to 8.4 million tons by 1975. Other estimates put the total SO2 emission for 1980 at 3 million tons, which means that it will decrease in the future. Although there might be a reduction in some areas, SO2 emissions will generally go up due to the increased consumption of fossil fuels. No economic process for the desulfurization of coal or heavy fuels is yet available. Light fuel oils can be catalytically desulfurized while additives such as lime and dolomite help to reduce SO2 emissions from combustion.

2800 APTIC NUMBER 20740

Spengler, Guenter and Gerhard Haupt
THE EFFECT OF FUEL ADDITIVES PREVENTING SOOT FORMATION IN THE COMBUSTION OF DIESEL ENGINES. (Ueber die Wirkung russhemmender Kraftstoff-Zusaetze bei der Verbrennung im Dieselmotor). Text in German. Motortech. Z. (Stuttgart), 31(3):102-108, 1970. 11 refs.

The soot preventing properties of 29 chemical compounds were studied in a diesel engine; 18 were metal-containing compounds and 11, organic compounds. All tests were performed with a one-cylinder four stroke diesel engine. Commercially available diesel fuel was used. The influence of the fuel/air ratio and of the number of revolutions on soot formation was studied. At 1650 rpm, a minimum of soot formation occurred. A clear relation between soot formation and the amount of oxygen present could be confirmed. At diminshed oxygen partial pressure, the soot formation clearly increased. The fuel/air ratio also influenced the formation of components adsorbed by soot. These components are primarily products of incomplete combustion of the fuel or of partial oxidation of the fuel molecules, or products of polymerization or condensation. The quantity of polycyclic aromatics increased slowly until the fuel to air ratio dropped to 1.1%; below that, the increase was rapid. Formation of aromatics and aldehydes depends largely on the fuel quantity and the oxygen partial pressure in the cylinder, as well as on the residence time. Of the metal-containing additives, methylcyclopentadienyl manganese tricarbonyl, ironpentacarbonyl, and tetraethyl lead were most effective. The effect of methylcyclopentadienyl manganese tricarbonyl began with the addition of 0.22g/l. Larger quantities (about 7.2 g/liter) were required with the use of organic additives. Also, their efficiency was not as high as that of metal containing additives. They were not able to remove more than 22% of the total soot content.

2801 APTIC NUMBER 21702

Sponsel, Kurt
FILTER FOR CLEANING GASES, VAPORS AND AIR. (Filter zur Reinigung von Gasen, Daempfen und Luft). Text in German. (Collo Rheincollodium Koeln GmbH, Bonn (West Germany), Werk Hersel) Swiss Pat. 450 816. 2p. Jan. 31, 1968. (Appl. Sept. 11, 1963, 7 claims).

A filter was devised for cleaning waste gases, vapors and air, which consists of an organic, hydrophilic open-cell foam matrix containing a catalyst. A redox system containing metal oxides is preferably used as catalyst, but other organic compounds such as enzymes and fermentations can be used too. The catalysts are incorporated on linear or meshed polyurethane foam. If the filter is used to clean the waste gases of combustion engines, phenolic resin can be used as matrix material. It is advantageous to add an emulsifier to the foam mass. If the filter is used for deodorizing waste gases, the foam mass should contain montmorillonite which adsorbs proteins and their decomposition products, while prolonging the activity of the filter.

2802 APTIC NUMBER 20878

Springer, Karl J.
AN INVESTIGATION OF DIESEL POWERED VEHICLE ODOR AND SMOKE (PART III). Southwest Research Inst., San Antonio, Tex., Vehicle Emissions Research Lab., NAPCA Contract PH 22-68-23, Rept. 11-2600, 766p., Oct. 1969. 12 refs.

A ten-person odor panel, trained in the characterization of dilute diesel exhaust samples according to the PHS quality/intensity rating kit and the PHS light-extinction smokemeter, were used to measure odor and smoke. A commercially available diesel fuel odor additive had no effect on perceived odor from three two-cycle Detroit Diesel 6V-71 E powered municipal buses, and inconsistent reductions in odor generally resulted from a catalytic muffler device, although certain of the chemical emissions such as hydrocarbons and carbon monoxide were generally always reduced. Both odor and smoke were less from similar buses powered by a 6V-71 N type engine. A number of truck-tractors with a variety of engines and drivelines were evaluated to develop dynamometer procedures and acquire limited baseline emissions. Due to low exhaust temperature and unsteady flow conditions with extended engine idle, the city bus exhaust represents one of the most difficult to treat by catalysis, and a number of catalytic devices employing both transition metal and precious metal catalyst coatings were unsatisfactory. An electrostatic precipitator was completely unsuccessful in reducing smoke according to the smokemeter, while fuel seemed to have little or no effect on perceived odor from three buses powered by 8V-71 N engines. A modified needle type or 'N' injector resulted in lower smoke, odor, and other emissions such as HC, CO, and acrolein under all conditions investigated. Correlation studies were undertaken to develop an instrumental technique to extend the usefulness of the trained odor panel, including the measurement of total hydrocarbons, carbon monoxide, carbon dioxide, nitric oxide, nitrogen dioxide and total aldehydes, formaldehyde and acrolein.

2803 APTIC NUMBER 20885

Spurny, Kvetoslav and Jan Hrbek
A COMMENT ON AEROSOL FILTRATION UNDER EXTREME CONDITIONS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(2):32-37, Feb. 1969. 14 refs.

Consideration is given to the filtration of pore filters (membrane

filters and nuclepore filters) under the conditions of low and high gas temperature and low and high gas pressures encountered in aerosol sampling, nuclear power plants, compressors, jet aircraft, spacecraft, and submarines. Equations are derived indicating that the impaction and diffusion separation of a pore filter depend on the gas viscosity and on the mean free path of gas molecules which in turn depend on the gas pressure and the gas temperature. Used in conjunction with a computer, the equations enable the temperature and pressure characteristics of an aerosol to be calculated. Experimental measurements of model aerosols obtained by radioactive labeling show that the pressure drop of a pore filter decreases with decreasing gas pressure. On the other hand, the total efficiency of a pore filter increases with decreasing gas pressure, especially at low velocities. Therefore, filter efficiency under normal conditions is about 22%, while at 100 mg Hg, it is more than 75%. For aerosol sampling in the higher atmospheric layers, filters with relatively large pores can be used. However, at high pressures, small-pore filters are preferable.

2804 APTIC NUMBER 21381

Squires, Arthur M.
CLEAN POWER FROM COAL, AT A PROFIT' . Preprint, American Association for the Advancement of Science, Washington, D. C., 36p., 1969. 48 refs. (Presented at the Symposium of the American Association for the Advancement of Science, Power Generation and Environmental Change, Boston, Mass., Dec. 28, 1969.)

Coal technology is discussed to support the conclusion that methods capable of suppressing sulfur dioxide emissions from coal and at the same time reducing power costs are feasible, if sufficient funds are made available for their development. The history of coal-firing techniques is reviewed, with emphasis on pulverized fuel firing now in general use at large power stations. Rising standards of air quality are putting this method under severe economic pressures; its simple, one-step combustion places the coal's sulfur promptly into a form difficult to collect and recover. New techniques of coal combustion, in which pollution control is a first consideration, hold greater hope for the future than makeshift schemes for control at the final point of pulverized fuel firing. These techniques, particularly the basic fluidized-bed process and subsequent modifications of it, are discussed in detail. For the future, attention is being directed to the concept of the 'Coalplex,' a producing complex in which chemical extraction and power generation would be integrated; one such scheme provides for the conversion of the volatile matter in coal to synthetic pipeline gas or liquid fuel. The fixed carbon would be desulfurized to produce a low-sulfur coke suitable to fluidized-bed techniques.

2805 APTIC NUMBER 20729

Squires, Arthur M.
PROCESS AND APPARATUS FOR DESULFURIZING FUELS. (Assignee not given.) U. S. Pat. 3,481,834. 21p., Dec. 2, 1969. 12 refs. (Appl. Aug. 21, 1968, 21 claims).

An improved method and apparatus are described for converting a sulfurous hydrocarbonaceous fuel, such as bituminous coal and residual oil, into fuel products low in sulfur; one of the products comprises of coke pellets. Fuel is charged to a lower zone of a fluidized bed, which comprises of the coke pellets, where the fuel is carbonized or cracked to form gaseous products and a fresh coke accrets upon the pellets. Gaseous products along with hydrogen fluidize a superposed, contiguous, upper zone of the fluidized bed; the upper zone comprises of a commingling of the coke pellets and a solid of smaller size containing a substance avid for sulfur from hydrogen sulfide, such as calcium oxide. The upper zone is fluidized at lower velocity than the lower zone, and the velocity of the lower zone is sufficient to prevent the smaller solid from penetrating deeply into the zone. Means are provided to ensure that, soon after a layer of fresh coke is formed on a given pellet, it goes to the upper zone, where the fresh coke is desulfurized through the cooperative action of the hydrogen and the smaller solid. Gaseous products are also desulfurized while passing through the upper zone. Fuel gas and coke, each low in sulfur, are withdrawn from the fluidized bed. (Author abstract)

2806 APTIC NUMBER 21540

Stairmand, C. J.
REPORT ON THE REMOVAL OF GRIT, DUST, AND FUME FROM EFFLUENT GASES. Chem. Engr. (London), 46(7):257-261, Sept. 1968. 17 refs.

Reports dealing with the removal of particles from the effluent gases of chemical process plants, and with problems in the removal of grit, dust, and fume encountered in Sweden, Switzerland, and Germany, are summarized. Standards of control are similar in all these countries and there is evidence that the technical problems can be solved; costs of effective control are high, however, and may reach 10-15% of the total plant cost. The difficulty of arresting particles increases with their fineness. Emissions are classified into coarse particles of sizes above 10 micron, particles between 1 and 10 micron and the true fumes which may give rise to industrial haze below 1 micron. Available control equipment is grouped in increasing order of efficiency: inertial collectors, electro-precipitators, wet scrubbers, and fibre and fabric filters. In general, the actual mass efficiency of the collector is less important than the 'slip', i.e., the amount of dust which escapes which must be related to the actual effect on amenities in a particular case. Detailed tables of summary data are presented on efficiency and cost of dust-arresting equipment, particular applications for equipment, and statutory or presumptive limits of emissions in Britain, West Germany, and Switzerland.

2807 APTIC NUMBER 21392

Stanfill, I. C.
START-UP EXPERIENCES AND SPECIAL FEATURES AT MEMPHIS LNG PLANT. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 11p. 2 refs. (April 7-12, Paper 2-7).

The problems are enumerated which occurred within a several

month period after the startup of the Memphis liquefied natural gas plant. They include leaks in the aluminum tubing of the ethylene condenser, major stress cracking of the cold box plate, sendout system leaks, and switchgear malfunction. Numerous electrical failures would occur, and some difficulty still exists in getting LNG pumps to hold pressure when first started. Check valves in the cooling water system did not have clearance to open all the way, while excessive vibration of process compressors and associated piping required extensive field bracing. Particulars of the Memphis plant are summarized, and two unique features of the plant are described. When peak shaving gas in excess of 25 million CF/day is needed, an interchange agreement will be put into effect to exceed contract demands at city purchase stations, then deliver LNG from storage to the supplier's pipeline for credit toward net purchases. Power requirements for holding constant tank level are reduced by switching from the normal cascade refrigeration cycle (propane, ethylene, and methane) to an expander cycle supplemented by the methane compressor. Thus, boil-off vapors are re-liquefied and returned to storage during holding.

2808 APTIC NUMBER 21210

Stark, Virgil
PROCESS FOR MAKING FUEL GAS. (North American Utility Construction Corp., New York) U. S. Pat. 3,481,721. 7p., Dec. 2, 1969. 7 refs. (Appl. June 29, 1966, 5 claims).

A process is described for the production of gas from a liquid hydrocarbon through a series of interrelated but distinct manufacturing steps, each step operating at optimum conditions to produce the desired gas of pre-determined heating value, gravity, and burning characteristics, suitable for peakload, standby, or baseload purposes. The steps of the continuous process consist of the thermal non-catalytic cracking of liquid hydrocarbon feedstock in the presence of a hydrogen rich reformed gas or steam, and the catalytic reforming of the cracked gas consisting mainly of lower weight paraffins and olefins, or natural gas or LP gas with steam to produce a reformed gas containing essentially hydrogen, CO, and CO2 with a small amount of low molecular weight hydrocarbons. The preferred raw material for the process is a petroleum hydrocarbon which is liquid at atmospheric pressure having a boiling range from about 100-700 F and is highly paraffinic. The properties of the various types of gases which can be produced in the thermal cracking step can be varied by such means as changing the thermal conditions employed during the cracking, the space velocity, residence time, and the composition of the reformed gas and its ratio to the feedstock. A gas having a range of heating values of from about 300 Btu/c.f. to 1200 Btu/c.f. and a gravity of 0.4 to 0.9 can be produced.

2809 APTIC NUMBER 20311

Stewart, Harold F. and Ray L. Walchle
AUTOMATIC X-RAY APPARATUS FOR LIMITING THE FIELD SIZE OF A PROJECTED X-RAY BEAM IN RESPONSE TO FILM SIZE AND TO SOURCE-TO-FILM DISTANCE. (Dept. of Health, Education, and Welfare) U. S. Pat. 3,502,878. 7p., March 24, 1970. 6 refs. (Appl. Sept. 22, 1967, 5 claims).

An X-ray field size limiting system is provided wherein the size of a projected beam or field from an X-ray source is automatically limited to the size of a recording film cassette, thereby eliminating unnecessary radiation exposure to the patient during diagnostic radiography. Automatic operation compensates for changes in source-to-film distance as well as changes in film cassette size. Servo-system techniques are employed to control the aperture of a field size limiting diaphragm or shutter means in response to signals produced by both a film or cassette size sensing means and a source-to-film distance sensing means. The inventive system provides for the use of an X-ray apparatus in a vertical position for table work and in a horizontal position for chest radiography. (Author abstract modified)

2810 APTIC NUMBER 21201

Stine, Laurence O. and Frank Stolfa
DESULFURIZATION OF HIGH METAL BLACK OILS. Universal Oil Products Co., Des Plaines, Ill.) U. S. Pat. 3,494,855. 7p., Feb. 10, 1970. 4 refs. (Appl. June 10, 1968, 7 claims).

A combination process for desulfurizing high metal-containing petroleum fractions to produce fuel oil conforming to specifications regarding sulfur concentration is described. The process involves the integration of hydrogenative cracking and catalytic desulfurization, and is especially applicable to those charge stocks characterized as being more than 10% by volume non-distillable, and containing more than about 150 ppm of metals. The fresh charge stock is admixed with a portion of a thermally-cracked product effluent to provide a combined feed ratio greater than 1.4:1, and hydrogen is admixed in a specified amount. (Author abstract modified)

2811 APTIC NUMBER 20282

Stirling, Harold Tamplin
SMOG RETARDER APPARATUS. (Assignee not given.) U. S. Pat. 3,499,428. 4p., March 10, 1970. 11 refs. (Appl. Feb. 20, 1968, 9 claims).

A smog retarder apparatus, designed for use with an internal combustion engine, is described. This device effectively removes sulfuric acid from a film of devolatized oil by a chemical reaction. The design and shape of the device facilitate vaporization of water and hydrocarbons from the oil by flowing a controlled stream of oil from the crankcase in a thin film over an evenly-heated long path heating element. Hydrocarbons and water vapors are returned to the engine intake manifold. They then pass to the combustion chamber where the hydrocarbons are oxidized. The presence of water vapor during combustion reduces the amount of smoke in the exhaust gases. Thus, the smog retarder apparatus is effective to directly reduce the amount of hydrocarbons and H2SO4 in the exhaust, and to indirectly

reduce the smoke and other contaminants by virtue of improved engine efficiency. A detailed description of the device is included.

2812 APTIC NUMBER 21378

Strauss, Hans-Jochen
A TEST PROCEDURE FOR ROLL-TAPE FILTERS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(10): 6-10, Oct. 1969. 2 refs.

Roll-tape filters are capable of cleaning an air stream with an almost constant pressure difference, i.e., without the latter increasing from an initial to a final value as is the case in plate air filters or other equipment with stationary filter media. Since the resistance of a roll-tape filter increases in the direction of its transport, the filter is distinguished from fixed filters by the air velocity distribution. A stepwise procedure for testing the efficiency of roll-tape filters is presented. The test is performed with samples of the medium mounted in a stationary position and with the difference in operating pressure given in advance. For each stage, the mean dust-laden and cleaned air and mean separation efficiency and mean velocity are estimated. The velocity distribution is graphically recorded. Unless the dust concentrations defined for each stage are given beforehand, this requires a sufficiently constant dust concentration in the air stream. In the graphic representation of velocity distribution, the mean velocity at which the roll tape is operated is plotted; the area corresponding to excess velocity is determined. The end point is determined from the equality of the areas of the excess velocity deficit. By averaging the dust concentrations up to the final point, the mean efficiency of the filter can be calculated.

2813 APTIC NUMBER 20772

Stuckey, Alto M., Noah E. Blackwell III, and Ignacio G. del Valle
PROCESS FOR THE PREPARATION OF LOW SULFUR FUEL OIL. (Esso Research and Engineering Co., Baton Rouge, La.) U. S. Pat. 3,475,323. 5p., Oct. 28, 1969. 6 refs. (Appl. May 1, 1967, 10 claims).

A low sulfur, low metal fuel oil is produced from a petroleum crude oil or distillation residue by mild coking, distillation, and hydrodesulfurization. If the metals such as iron, nickel and vanadium are present in the fuel, they attack the refractories used to line boilers and combustion chambers, cause slagging and build-up of deposits, and severely corrode high temperature metallic surfaces with which they come into contact. The hydrodesulfurization is carried out with a minimum conversion of fuel oil components to gas and light ends, and with a reduced deposition of carbonaceous and metal materials on the catalyst, whereby the desired reduction in the sulfur content of the fuel is obtained over long periods at consistently high catalytic activity and life and at moderate conditions. Coke from the coking step is treated to produce hydrogen and to recover a high metal coke concentrate. Fuel oil feed containing at least 1.0 wt percent sulfur, at least 100 ppm metals, and at least 5 wt percent asphaltenes is treated in a fluid coking step at 900-1100 F in the presence of 5-100 wt percent steam. The total coker overhead products boiling above 600 F, or a fraction of the coker products boiling in the gas oil boiling range, are desulfurized at 500-900 F at 500-3000 psig in the presence of a hydrogen-containing gas and a catalyst comprising a salt of a Group V-B or Group VIII-B metal. At least a portion of the hydrogen used in the process is obtained by recovering fluid petroleum coke, burning it, and reacting it with steam.

2814 APTIC NUMBER 20879

Stukel, James Joseph
TURBULENT FLOW OF SUSPENSIONS OVER PARALLEL PLATES. Illinois Univ., Urbana, Dept of Mechanical Engineering, Thesis (Ph.D), Ann Arbor, Mich., Univ. Microfilms, Inc., 1968, 102p., 42 refs.

An understanding of the nature of suspension flows is relevant to the design and evaluation of air pollution control equipment, including electrical precipitators for the control of dispersoids. In the present investigation, the fluid mechanic aspects of precipitators were studied to determine fundamental interactions between the carrier gas and the charged particles and to clarify the role of the boundary layer in gas-electrical interactions. The test configuration chosen was particulate flow over parallel plates, which was visualized as a flow over a flat plate with pressure gradient. The following parameters were measured to describe the particulate flow: carrier velocity, the particulate mass flux density distributions, the particulate density distribution, the charge to mass ratio, and the average particle size of the suspension. Experimental results were generalized through dimensionless coefficients, namely, the gas-particle momentum and electroviscous numbers. The conclusions reached are the turbulent flat plate relationships for displacement thickness of the gaseous phase and the particulate phase can be used for the entrace region of parallel plates, providing modifications are made for the change in the free stream velocity and gap width when a sample probe is used. Isokinetic conditions are sufficient for measuring the particulate mass flux, regardless of the relationship between velocities of the gaseous and particulate phase. They are not sufficient for determining stream concentrations with a sampling probe. The particle-fluid interaction length is a useful parameter for estimating the particle slip velocity, and the particle wall flux has a sharp peak near the entrance to the plates.

2815 APTIC NUMBER 20763

Sullivan, Herbert D.
ROTARY SCREEN SEAL. (International Harvester Co., Chicago, Ill.) U. S. Pat. 3,475,883. 3p., Nov. 4, 1969. 5 refs. (Appl. June 21, 1967, 6 claims).

Rotary air screens were developed to cleanse the air used to cool the engine powering a combine, as a cloud of dust is created in harvesting grains, and an improved seal is provided between the peripheral edge of a rotary screen and its stationary housing. The

seal is in the form of a continuous ribbon of brush fixed on either the housing or the rotatable filter with the free ends of the brush in frictional engagement with the other member. The brush may be made from short and long bristles to form a sparse edge and a dense base that will completely block the passage of air and result in lower frictional losses than if all the bristles were of the long length.

2816 APTIC NUMBER 20409

Swiss, M.
METHANE STORAGE NEAR NEW YORK. J. Refrig., vol. 8:309-310, Oct. 1965. 2 refs.

An in-ground storage plant for liquid methane functions as a 'peak-shaving' reserve equal to an alternative storage capacity of 200 million cu ft/day. Plant capacity is 796,000 bbls of liquid. The storage cavity, which is surrounded by a concrete wall 15-ft high, was dug in a marshy, tide-swept meadow. Before the digging began, the mud and the marl below the water table were frozen with propane to a thickness of 10 ft. They may eventually become frozen to a thickness of 30-50 ft from the cavity wall. Five million cu ft/day of liquid methane will be injected into the storage tank throughout the summer. During peak winter demand, 200 million cu ft of gas per day can be removed for delivery to New York. The natural gas liquefaction equipment includes three 440 hp units functioning as compressors for inlet gas and for flash gas and boil off, two 100 hp units for propane and ethylene refrigeration, and two 40 hp units for boosting flash and boil-off gas. The boil-off and flash are mixed and compressed, then delivered to the pipeline or used as fuel for the refrigerating equipment. The cost of the storage project (1965) is estimated to be 12 million dollars, or less than that of high-pressure storage vessels or combinations of refrigerated and high-pressure storage.

2817 APTIC NUMBER 20299

Tajiri, Kei
SCOPE OF FUPI OIL DESULFURIZATION FOR JAPANESE REFINERS. (Juyu datsuryu no genjo to shorai). Text in Japanese. Nenryo Kyokaishi (J. Fuel Soc. Japan, Tokyo), 49(515):123-130, March 1970.

In response to requirements limiting the sulfur content of fuel to 1.7 wt percent, Japanese refineries built topped crude desulfurizers or vacuum gas oil desulfurizers. The refineries are now endeavoring to determine the optimum operating conditions of these desulfurizers to satisfy the more severe sulfur-level requirement which is expected to be set at less than 1.5 percent in the near future. It is noted that no type of desulfurizer can be economically operated at the current price level of fuel oil. Moreover, reducing the sulfur level of fuel oil to less than 1 wt percent will not solve the air pollution problem in densely populated areas where the number of factories burning oil is expected to double. New processes for producing more gaseous fuel must be explored.

2818 APTIC NUMBER 21606

Talhouet, Loic de
GAS AND WATER MIX WELL. Cryogenic Eng. News, vol. 2:22-26, April 1967.

The technical and economic characteristics of liquefied petroleum gas and liquefied natural gas are outlined; conditions are given under which their transportation and storage techniques were perfected, and the present and future exchange zones and traffic routes for the products are defined. The fully-pressurized ship for LPG transport is only economical, in most cases, for the smaller cargoes of 1000 cubic meters or less, while the semi-refrigerated ship (+5 C) is the best solution for capacities larger than 4000 cubic meters. For ships of an intermediate capacity, the solution depends on particulars of the traffic, and more specially on the characteristics of land storage. Refrigerated transportation at atmospheric pressure is nearly always the best solution for larger ships of more than 10,000 cubic meters. With Northern Europe and the Mediterranean areas serving as the two principle export zones for LPG, Japan, Brazil and Argentina have become the most important import points. The first commercial LNG route goes from Algeria to France and Great Britain, and one and a half million cubic meters per year are transported on three ships ranging in capacity from 25 to 27,000 cubic meters. The solution of storing LNG at -160 C and atmospheric pressure does away with the problem of adapting the ships to meet temperature and pressure requirements, but it calls for thorough studies and experimentation with materials from the standpoint of operation and fabrication characteristics.

2819 APTIC NUMBER 20777

Tamura, Zensuke and Yukio Nishimura
A PROCESS AND APPARATUS FOR THE DESULFURIZATION OF INDUSTRIAL WASTE GASES. (Hitachi, Ltd., Tokyo (Japan)) U. S. Pat. 3,486,852. 6p., Dec. 30, 1969. 4 refs. (Appl. Sept. 21, 1967, 20 claims).

A process and apparatus for desulfurizing industrial waste gas and recovering sulfuric acid as a byproduct are described. A portion of the waste gases are introduced into an adsorption tank to remove the sulfur oxides by contacting them with active carbon, while the remaining portion is sent to a region for drying the active carbon which has been wet in a preceeding rinse-desorption step. From the drying tank the gases are led to the adsorption tank. Waste gases free of sulfur oxides are released to the atmosphere from the adsorption stage. Sulfur oxides are removed from the active carbon by rinsing with water, and the washings are removed and sent to a concentration tank where they are heated and sulfuric acid is recovered. The functions of the respective regions is the adsorption-desorption apparatus are shifted one after another at a certain time interval, so that a cycle of operation consisting of adsorption, rinsing-desportion and drying, is carried out concurrently repeatedly.

2820 APTIC NUMBER 20951

Tarlton, L. C., Jr. and W. D. Bloebaum, Jr.
LNG TRUCK TRANSPORTATION. Gas Age, 1968: 15-17, Sept. 1968.

Truck transportation of liquefied natural gas is an economically and technically feasible method to supply natural gas to communities not served by pipeline distribution facilities. Two communities that were served in this way for short periods of time were supplied from small trailers carrying 600 gal of LNG, equivalent to about 40 Mcf of natural gas. In one of these systems, the LNG was vaporized by a truck-mounted mobile vaporization system that included ambient-air vaporizer, regulators, odorizers, and all other equipment needed so that revaporized gas could be fed directly into the distribution main. Two areas receiving longer-term supplies utilize 6000-gal tractor-trailers. The cryogenic, dewar design of these trailers permits long-distance hauls to be made with very low heat leak into the LNG. Much of the cryogenic equipment needed is already available as off-the-shelf hardware. The economics of both short- and long-term service are favorable. In one town, the total cost of supply for 12 hours was less than $2000.

2821 APTIC NUMBER 20889

Tatto, David L. Del
SATELLITE PEAK SHAVING. Am. Gas J., 195(7):36-38, June 1968.

A liquefied natural gas installation now under construction in Wisconsin is described which applies the concept of a single 'primary' liquefaction and storage plant serving remote satellite facilities. The satellite peak shaving facility will be located about 100 miles from the primary plant. The satellite facility will serve the following functions: storage of LNG until required for peak shaving; a receiving facility for LNG trailers; and a send-out and vaporization system for supplying natural gas to the company's distribution main. The primary plant and satellite facility are described; the most important components will be the above-ground aluminum double wall storage tanks. The nearness of the satellite plant to the company's distribution area, and also to railroad and barge facilities, make it an excellent distribution center and will permit flexibility for future expansion, particularly if barge delivery of liquid LNG becomes economically feasible.

2822 APTIC NUMBER 21370

FELT FILTERS SERVE MANY INDUSTRIES. Textile J. Australia, 39(9): 27, Sept., 1964.

The suitability of felt for filtering impurities or recovering solids from fluids and gases is noted, and test procedures for determining pressure loss/air velocity characteristics of felt samples are summarized. In one test, the felt sample is installed between the flanges of a ductwork system. Static pressure tappings are incorporated within the walls of the test housing at points immediately upstream and downstream of the samples; these are coupled to an inclined manometer to indicate the pressure differential across the medium. Air flow through the system is metered by a square-edged orifice plate. The pressure differential across the plate is similarly read by coupling static pressure tappings to a manometer. The same apparatus is employed for a methylene blue test but the duct in the upstream half of the housing is extended to ensure evaporation of water droplets generated by the methylene blue atmoizers. Pipes are positioned upstream and downstream of the felt sample, each pipe fitted with filter paper. The efficiency of the test is determined by assessing the volumes of samples required to produce stains of equal density on the filter papers. The particle size distributions of a methylene blue cloud are given. It is further noted that the efficiency of the test is improved by reducing air velocity.

2823 APTIC NUMBER 20285

Theed, William D. L.
EXHAUST PURIFICATION. (Godfrey (Sir George) and Partners Ltd., Middlesex (England) U. S. Pat. 3,498,054. 3p., March 3, 1970. 5 refs. (Appl. Dec. 14, 1965, 11 claims).

An arrangement for purifying the exhaust gas from an internal combustion engine is described. A catalytic chamber is included in the exhaust pipe and is supplied with air by a positive displacement diaphragm pump which is operated by the pressure depression at the engine induction. A venturi is also assembled in the exhaust pipe for passage of the exhaust gases. A connection from the throat of the venturi leads to the reservoir through a non-return valve. A changeover valve on the pump mechanically operates to connect the chamber of the diaphragm pump to the atmosphere.

2824 APTIC NUMBER 21153

Thijssen, J. J. H. and P. Ziekman
AEROSOL FILTRATION BY ELECTRIFIED FIBROUS FILTER MATS. II (A64/KL/022). (Elektreetfilters. II (A64/KL/022)). Text in Dutch. Rijksverdedigingsorganisatie TNO, Rijswijk (Netherlands), Chemisch Lab., 16p., Aug. 1969. 3 refs.

Because of the adverse effect of loading with liquid aerosol on their filtration properties, filters of electrified polypropene or polyethyleneterephthalate can be used only to filter low concentrations of aerosols. By combing a good mechanical filter with an 'electret' filter, the penetration can be lowered by a factor of 10-100 with negligible increase in resistance to air flow. This factor of 100 can probably be further increased by a suitable choice of material and the conditions of formation of the electrified fibrous filter mat. (Author abstract modified)

2825 APTIC NUMBER 21382

Thijssen, J. J. M.
AEROSOL FILTRATION BY ELECTRIFIED FIBROUS FILTER MATS. I. (A64/KL/022). Text in Dutch. Rijksverdedigingsorganisatie TNO, Rijswijk (Netherlands), Chemisch Lab., Rapport 1969-14, 23p.,

1969. 11 refs.
CPSTI: M70-16092

The data and some qualitative conclusions are given of an investigation of the potentials of aerosol filters composed of electrified synthetic fibers. It was found possible to obtain such fibers which, when formed into a fibrous filter mat, show increased efficiency compared with non-electrified fibers. The pressure drop across the filter is very low. (Author abstract modified)

2826 APTIC NUMBER 21010

Thomas, Ward
CONDENSER AIR LINT FILTER. (T and P Mechanical Co., Inc., Corpus Christi, Tex.) U. S. Pat. 3,486,313. 4p., Dec. 30, 1969. 11 refs. (Appl. Dec. 20, 1967, 5 claims).

Filter apparatus is described for extracting lint fly and dirt from the exhaust air discharged from cotton processing equipment and disposing the lint fly and dirt in a manner which will minimize air pollution problems in the vicinity of cotton gin buildings. Exhaust air discharged from the cotton processing apparatus is withdrawn through a rotary cylindrical drum covered with a fine wire cloth to effect deposit of the fine particles of lint fly and dirt on the surface of the drum and produce their discharge into a collection receptable. The housing surrounding the cylindrical drum is designed to compress the inlet in such a manner as to effect pneumatic sweeping of the collected particles on the surface of the drum to a hopper to achieve self-cleaning of the drum's surface.

2827 APTIC NUMBER 20290

Thompson, William H. and Eldred E. Young
REMOVAL OF ELEMENTAL SULFUR FROM PETROLEUM OIL CONTAMINATED WITH SULFUR. (Shell Oil Co., New York) U.S. Pat. 3,501,397. 2p., March 17, 1970. 1 ref. (Appl. March 21, 1969, 3 claims).

A method of purifying elemental sulfur contaminated oil, separated and recovered from sulfur-oil slurries, is described. Elemental sulfur can be separated from crude oil by contacting such oils with an aqueous solution containing polysulfide forming compounds. The contaminated oil is contacted, treated, and reacted with such a solution, having a pH of at least 7, at a temperature and for a period of time sufficient to effect a chemical reaction between the elemental sulfur and the solution. The oil phase is separated from the aqueous phase. The separated aqueous phase is treated to effect a breaking down of the polysulfides to elemental sulfur and other by-products, and the sulfur is removed by filtration, centrifuging, or gravity settling.

2828 APTIC NUMBER 20660

Thompson, William H. and Eldred E. Young
REMOVAL OF ELEMENTAL SULFUR CONTAMINANTS FROM PETROLEUM OILS. (Shell Oil Co., New York) U. S. Pat. 3,489,677. 2p., Jan 13, 1970. 2 refs. (Appl. Nov. 20, 1967, 11 claims).

A method is described for removing elemental sulfur from contaminated petroleum oils by treating the oil with an aqueous solution containing a mixture of alkali hydrosulfide and hydroxide, e.g., ammonium hydrosulfide and ammonium hydroxide. The ratio of the oil to the contacting or treating aqueous solution can be varied over wide limits of from 20:1 to 1:20 and preferably between 10:1 and 5:1, respectively, and the treatment can be carried out at ambient temperatures or elevated temperatures, but preferably below 200 F. The aqueous phase can be separated from the oil phase by any suitable means such as gravity settling or centrifuging, while the ammonium polysulfide solution recovered can be decomposed in a closed vessel or under a nitrogen blanket to exclude air. Thus, on heating or distillation of the solution, either liquid or granular solid yellow sulfur is precipitated and removed, while ammonia, hydrogen sulfide, and some water are given off, collected, cooled and recycled. When necessary or desirable, the treated oil can be further contacted with additional amounts of the aqueous treating solution to effect removal of any sulfur which has not been removed by the initial treatment and the process can be repeated until essentially all of the entrained and dissolved elemental sulfur is removed. Elemental sulfur contaminated oils having a sulfur content of from about 1-2% can be reduced by this process to values of less than 0.01%.

2829 APTIC NUMBER 20726

Thornton, James F.
PROCESS FOR ABSORBING SO2 FROM GASES WITH ALKALINE EARTH METAL OXIDES. (Lummus Co., New York) U. S. Pat. 3,475,121. 3p., Oct. 28, 1969. 4 refs. (Appl. Nov. 16, 1966, 4 claims).

A process for absorbing sulfur dioxide from a stack gas is described, by introducing a finely divided alkaline earth metal oxide into the gas whereby the sulfur dioxide reacts to produce the corresponding sulfite. The flue gas containing sulfur dioxide and some sulfur trioxide is mixed with an alkaline earth metal oxide, preferably calcium oxide, magnesium oxide, or mixtures thereof at a temperature between about 250-1000 F to produce an alkaline earth metal sulfite and some alkaline earth metal sulfate. Best results are obtained when the oxide is present in an amount at least 1.5 times greater than the stoichiometric amount of sulfur which is present in the fuel. The sulfite is heated to above the decomposition temperature, preferably to at least 1200 F, to produce sulfur dioxide and the corresponding metal oxide. The sulfur dioxide may be used to produce sulfuric acid and the metal oxide is recycled to the operation for removing sulfur compounds.

2830 APTIC NUMBER 21883

Tisdall, D. E.
DEVELOPMENT OF A MEMBRANE FOR THE CARRIAGE OF LIQUID METHANE BY SEA. PART I. Welding Metal Fabric., 34(6):218-222, June 1966. PART II. Ibid., 34(7):262-265, July 1966.

The technical and practical difficulties in designing a membrane tank for transporting liquid methane by sea are described. The membrane chosen employs plain sheets of material surrounded by corrugations in an articulated tray system to minimize the induced stresses by giving the sheet additional flexibility. Testing procedures were devised to measure contraction, pressure, and thermal fatigue life. Tests were conducted on a model membrane in a simulated environment. Problems encountered during the manufacture of a full-scale membrane are reviewed, and installation and testing of the full-scale membrane are described.

2831 APTIC NUMBER 20625

Tsuiji, M., T. Okuno and T. Yamamoto
STUDIES ON ODOR ADSORBING ABILITY OF ADSORBENTS AND THEIR APPLICATION TO ODOR SOURCES. PART II. (Kyuchakuzai ni yoru akusho no johoritsu o,obi hasseigen ni okeru riyoho no kento (II). Text Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):71, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The continuous flow of odorous gas through the adsorbent tower reduces the effectiveness of the adsorbent until the equilibrium state is attained. It is then necessary to exchange the adsorbents or to reactivate them. The change in the amount of adsorption due to temperature of reactivation and the frequency of reactivation was studied. The change in the surface structure of the adsorbent during gas release due to reactivation heating was investigated. In order to confirm that during heating, the released gas reacts with oxygen in air and the adsorbent surface, the resulting gas was analyzed. The adsorbents used were vegetable-type activated charcoal, sulfonated coal, and MGP. The odorous gases were hydrogen sulfide, mercaptan, ammonia, methylamine, dimethylamine, and trimethylamine.

2832 APTIC NUMBER 21694

Oehlinger, Kurt
PROCESS AND DEVICE FOR CLEANING THE IMPELLER OF VENTILATORS USED FOR EXTRACTING DUST-LADEN GASES. (Verfahren und Einrichtung zur Reinigung des Laufrades von Ventilatoren fuer die Foerderung staubiger Gase). Text in German. (Roll AG) Swiss Patent 455 128. 2p., April 30, 1968. (Appl. September 29, 1967, 10 claims).

Cleaning of the impeller is accomplished by the periodic action of high-speed compressed air, this stream of air blowing away the dust deposits from the impeller blades. Shutoff and regulating valves are located in the line bringing the compressed air to the nozzles from which the air is blown. These valves are located in close proximity to the nozzles. The invention is foreseen to have a special application to the burning of refuse, in which application it will permit operation of the equipment for a period of several months without the type of maintenance that would require discontinuation of service, whereas previously such work stoppage was necessary every 3-4 weeks.

2833 APTIC NUMBER 20436

Vaillant, G.
THE BATTLE AGAINST AIR POLLUTION IN THE FERTILIZER INDUSTRY. (La lutte contre la pollution atmospherique dans l'industrie des engrais). Text in French. Inform. Chim. Numero Spec., 69(83): 63-66, 69, Dec. 1966. 10 refs.

Sulfuric acid is widely used in the production of ammonium sulfate, superphosphates, phosphoric acid, potassium sulfate, and other fertilizers. The oxidation reaction is never complete and sulfur dioxide and sulfur trioxide are present in concentrations of 0.1 to 0.2% in the waste gases. Dry methods of their purification are briefly described; the wet methods involve scrubbing with an alkaline aqueous solution and utilize different reactions to recover either pure S or definite S compounds, such as sulfates or mixtures of sulfites and bisulfites. A wet method for recovery of ammonium sulfate utilizes the overall reaction: $2SO_3H(NH_4) + SO_3(NH_4)_2 + 2H_2SO_4$ yields $2SO_4(NH_4)_2 + 3SO_2 + 3H_2O$. The nitrogen-bearing fertilizers are produced by neutralization of nitric acid by the corresponding base. This acid is obtained by oxidation of ammonia. The air-pollution is due to incomplete oxidation of the intermediately formed nitric oxide to nitrogen dioxide and to incomplete dissolution of NO_2 in water, so that the waste gas contains 0.2 or more % NO. Present day methods of their purification are not efficient and uneconomical. Natural phosphates used in the production of phosphor-bearing fertilizers contain 3 to 4% fluorine in the form of CaF_2, which is liberated as HF or as SiF_6H_2 when the phosphates are treated by an acid. A method of removal of F compounds from the waste gases developed in France is described in some detail.

2834 APTIC NUMBER 21011

Vautrain, Lucien H. and Darrel W. Hughes
PLURAL STAGES OF SULFUR REMOVAL. (Phillips Petroleum Co., Bartlesville, Okla.) U. S. Pat. 3,474,027. 4p., Oct. 21, 1969. 4 refs. (Appl. June 19, 1967, 7 claims).

A hydrocarbon contaminated with acidic compounds, including hydrogen sulfide and mercaptans, is contacted in a first treating zone with highly spent caustic for a time sufficient to remove at least a portion of the hydrogen sulfide from the hydrocarbon and to substantially react the high spent caustic to NaSH, a valuable sulfide product. The treated hydrocarbon is transferred to a second treating zone where it is contacted with partially spent caustic for a time sufficient to remove substantially all of the remaining hydrogen sulfide from the hydrocarbon, thereby producing the highly spent caustic solution used in the first zone. It is then transferred to a third treating zone where it is contacted with fresh aqueous caustic solution comprising sodium hydroxide, for a time sufficient to remove substantially all the mercaptans from the hydrocarbon. The caustic solution is centrifuged between stages to remove undesirable solid impurities.

2835 APTIC NUMBER 20767

Vecchio, Luigi
EXHAUST GAS SCRUBBER. (Assignee not given.) U. S. Pat. 3,485,015.

Rp., Dec. 28, 1969. 22 refs. (Appl. March 28, 1966, 8 claims).

An exhaust gas-purifying device is described which will operate at high pressures and highway velocities without a significant loss of scrubbing fluids. It consists of a housing with a number of chambers, each forming at least one liquid bath through which the exhaust gas passes whereupon it is released to the atmosphere. A baffle receives and diverts the direction of the scrubbed fumes, and also reduces the escape of liquid from the scrubber. An inspection device, which divides the scrubbed gases into a main flow and a sample flow which is diverted to it, is included for determining the effectiveness of the scrubber. When the scrubber is operating normally, the liquid in the inspection bath is clear, but if noxious fumes are being exhausted from the scrubber, the liquid turns dark and the effectiveness of the scrubber can be determined.

2836 APTIC NUMBER 20326

Wesely, Kenneth D. and Harold D. Gass, Jr.
HYDRODESULFURIZATION CATALYST PREPARATION. (Universal Oil Products Co., Des Plaines, Ill.) U. S. Pat. 3,496,117. 3p., Feb. 17, 1970. 4 refs. (Appl. Oct. 2, 1967, 10 claims).

A hydrodesulfurization catalyst is prepared by impregnating molybdenum and/or other Group VI-B metal, and nickel and/or other iron group metal on a carrier material from a common ammoniacal solution. The impregnation is carried out in stages; each stage is followed by calcination at oxidation conditions. Catalyst containing an excess of about 3.5 weight percent nickel and/or other iron group metal, in an excess of 7.0% molybdenum and/or other iron group metal, in an excess of 7.0% molybdenum and/or other Group VI-B metal are prepared in improved yield. The catalytic reforming of various petroleum fractions including straight run gasoline, natural gasoline, catalytically cracked naphtha fractions, thermally cracked hydrocarbon distillates, and the like, is a particularly advantageous method of improving the anti-knock characteristics, or octane rating, of the petroleum fractions. (Author abstract modified)

2837 APTIC NUMBER 21395

Vogelhuber, W. W. and H. C. Parish
COMPACT LNG SYSTEM USING LARGE STIRLING CYCLE COLD GAS REFRIGERATOR. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 12p. (April 7-12, Paper 5-28).

A liquefaction system is discussed which utilizes a Cold Gas Refrigerator operating on the stirling cycle to remove some or all of the sensible and latent heat from natural gas. For capabilities below about 1.4 MMCFD, the CGR system would be expected to have a lower initial cost than conventional systems. The unit comprises an ambient temperature drive and a cylinder assembly which houses a compression piston and a displacer piston, both coupled to a unique rhombic drive mechanism by separate connecting rods. The rhombic drive produces sinusoidal phased harmonic motions of the two pistons which alternately compress, transfer, and expand the working fluid (hydrogen or helium gas) within the cylinder. Space just beneath the displacer piston is used for compression, while the space above the displacer is used for expanding and cooling the working medium. These sections are connected by a channel containing three heat exchangers. If the refrigeration capacity requirement exceeds that of a single cylinder, two, three or four cylinders may be combined to form a single, multi-cylinder unit with a common drive shaft. An advantage of the multi-cylinder unit is the capability of operating the cylinders at different temperatures, while it is a relatively compact unit resulting in minimum field installation effort. The CGR unit can be charged, started and cooled to operating temperatures within ten minutes. It is generally insensitive to load variations and if load and capacity are unbalanced, the condensing temperature will change until a new equilibrium point is reached. Features of the CGR system promote its use in an installation where redundant refrigeration capacity is required, as in barge transport of liquefied natural gas or other cryogenic fluids.

2838 APTIC NUMBER 21257

Walker, A. W.
ONE BILLION CF OF LNG AT LOWELL. Pipe Line Ind., 29(4):83-85, Oct. 1968.

A liquefaction, storage, and regasification facility at Lowell will take natural gas from a pipeline during the summer months for storage as a liquid, then return it as necessary during the winter months. Using a combination of turbo-exchanger and cascade cycles, the plant will achieve economical operation at a variety of output levels. The storage vessel is the double-walled 9% nickel steel variety, with perlite insulation under positive pressure. Both roofs are assembled on the bottom of the tanks, then air-lifted into place. An electrical heating system has been provided to maintain the foundation at a uniform temperature, removing the possibility of foundation frost heave. Surrounding the entire tank is an earth dike to contain possible spillage.

2839 APTIC NUMBER 20662

Walker, Brooks
EXHAUST RECYCLE ON DECELERATION WITH PURGING SYSTEM FOR FILTER. (Assignee not given.) U. S. Pat. 3,491,736. 3p., Jan. 27, 1970. 9 refs. (Appl. July 26, 1967, 9 claims).

A system is described for an internal combustion engine of automatically shutting off the exhaust and fuel on deceleration and recycling the exhaust through a cannister filter using an absorbent such as activated carbon. A suction sensitive valve is included for purging a cannister that absorbs gases developed in this system. It closes off the purging on idle and opens it to varying degrees as the suction drops below idle. When recycling the exhaust on deceleration, there will probably be a positive

pressure in the exhaust and a negative pressure in the intake; a check valve will prevent exhaust in going out through the clean air passage to the cannister. Control of the exhaust recycle is operated by two valves in a series: one, a valve or port that is open when the throttle is closed, in series with a speed sensing valve open above a predetermined engine speed.

2840 APTIC NUMBER 21337

REDUCTION IN SOLVENT VAPOR DISCHARGE. (Auswurfverminderung von Loesmitteldaempfen). Text in German. Wasser Luft Betrieb, 13(10): 385-387, Oct. 1969.

Solvent vapors can be removed from waste gases by condensation, absorption, or adsorption. With the condensation method, the solvent vapor/air mixture is cooled to temperatures below the dew point so that the vapors are condensated. The quantity of vapor remaining in the gas depends on the partial pressure of the substance and the temperature of the gas phase at the end of the cooling path. In the absorption process, the vaporous pollutants are scrubbed out of the gas by liquids in which the pollutant dissolves readily. At low concentrations, the solubility of the vapor in the scrubbing fluid obeys Henry's law c equals L.p, where c is the concentration of the substance dissolved in the scrubbing fluid, p is the partial pressure of the substance in the gas phase, and L is a solubility constant. For adsorption of vapors, aluminum oxide, silica gel, molecular sieves, or activated charcoal is used. Thermal conversion at temperatures above 800 C is the safest and simplest method. The reaction temperature can be decreased to between 300 and 450 C through the use of catalysts. The VDI (Association of German Engineers) guidline 2280 demands that all gases containing 1000 mg solvent and more (class I)/cu m be subjected to a cleaning process. The solvents are grouped into 6 classes. The limit concentration for class II is 500 mg/cu m; for class III, 250 mg/cu m; class IV, 120 mg/cu m; and class V, 20 mg/cu m. Ethanol, the only solvent belonging to class O, has a limit concentration of 2000 mg/cu m.

2841 APTIC NUMBER 21298

THE THEORY OF PHYSICAL SURFACE ADSORPTION. (Zur Theorie der physikalischen Oberflaechenadsorption). Text in German. Wasser Luft Betrieb, 14(4):147-148, April 1970.

Each practical application of an adsorption process makes use of the different surface energy of substances of different physical states, e.g., gaseous and solid states. As long as no chemical reaction takes place, the absorption is a pure surface adsorption. The free surface energy (van der Waal's forces) determines the activity of an adsorbent. Activation of an adsorbent means creation of a large surface. The best adsorbent is activated coal which, among other things, is used for adsorption of gaseous pollutants from atmospheric air. The surface energy of the adsorbent must surpass that of the substance being adsorbed. Apart from the molecular structural forces acting on the surface, the concentration increase of, for instance, the gaseous substance on the surface of the solid, too, has its part in the adsorption process. The adsorption capacity depends on the critical temperature and on the boiling point of the gases to be adsorbed. Moreover, the amount of gaseous pollutants adsorbed depends on the residence time in the adsorbent. The residence time of a gas in an adsorbent can be roughly determined with the formula: residence time equals the volume of activated coal (in liters) divided by the volume flow (in liters/sec).

2842 APTIC NUMBER 20611

Wayne State Univ., Detroit, Mich.
APPLYING NASA TECHNOLOGY TO AIR POLLUTION-THE SULFUR DIOXIDE PROBLEM. (FINAL REPORT.). NASA Contract NSR 23-006-044, 25p., 1969. 26 refs.
CFSTI: N69-39189

An attempt was made to identify potential contributions of aerospace technology to the problems of air pollution particularly sulfur dioxide emissions from power plants. Possible technical solutions are considered in terms of Pareto-Optimal and Kaldor-type criteria. A Pareto solution and its benefits would involve supplying or modifying an energy source which is both cheaper and cleaner than the current source. The Kaldor criteria assumes net benefits to the system, with the gains of one group offsetting the losses of another. The technological breakthrough potential, as indicated by the wealth of aerospace literature, for sulfur dioxide control implies the use of modified fuel cells for generating high voltage DC power. This will make it possible to continue to use air as an oxidizing agent without the burden of four unwanted nitrogen atoms for every oxygen atom produced. As a result, sulfur dioxide and other combustion products will not be too diluted to make recovery economically unfeasible. The solution meets the Pareto criteria, since a high efficiency, coal oxidation, solid electrolyte fuel cell may well be feasible in terms of capital equipment, operating costs, and DC power production.

2843 APTIC NUMBER 20603

Weber, Ekkehard
PRESENT STATE AND AIM OF BASIC RESEARCH IN WET SCRUBBERS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(7):12-18, July 1969. 16 refs.

The influence of gravity and that of diffusion and condensation on the entrainment of dust particles in wet scrubbers were studied by observing the impact behavior of glass spheres and of dust samples composed of particles of varying wettability. In general, all particles and spheres which hit a water drop were captured. Those that were readily wettable or impacted the surface with high kinetic energy penetrated to the interior of the water drop. Particles that were difficult to wet were expelled from the interior but retained on the surface of the water drop by adhesive forces. The conclusion that wetting plays a decisive role only in the deposition or entry of particles was confirmed by an examination of the measured efficiencies of wet scrubbing hoods of cold-blast cupola furnaces. A comparison of the efficiencies indicates that wetting behavior is of no particular importance in

the wet scrubbing of gases. Absorption is generally always effected when the dust particles and water drops collide. If high separation efficiencies are desired, a primary effort must be put into leading the dust particles toward the washing liquid.

2844 APTIC NUMBER 21705

Weinberger, S. M., L. J. Navarro, and C. F. Bonilla
DESULFURIZATION OF PETROLEUM WITH LIQUID SODIUM. (Desulfuracion de petroleo con sodio liquido). Text in Spanish. Rev. Soc. Quim. Mex., 14(1):13-16, Jan.-Feb. 1970. 12 refs.

The cost of catalysts and equipment for desulfurizing fuel oils with hydrogen is very high, and involves working under conditions of high temperature and pressure. The use of sodium and certain other alkali metals is more economical, especially since there is a profitable market for sodium sulfide in the paper and fertilizer industries, with the possibility of its use in making sulfuric acid and sulfur phosphates. Experiments were conducted on the desulfurization of n-dodecane containing known quantities of n-propyl sulfide, thiophene, and n-butyl mercaptan, using liquid sodium as a continuous phase in an unpacked column. For each sulfur compound, the effects of temperature, thickness of the contact layer, and the quantity of sodium consumed were studied. The recovery yield of sodium sulfide was also examined in relation to the amount of sodium used. In every case, the maximum speed of reaction was obtained for the highest temperature and largest amount of sodium used. Results are tabulated for tests using 75 ml of sodium and a processing temperature of 165 deg. The sulfur of n-propyl sulfide is completely absorbed; in the case of thiophene there is a 0.38% residue and for n-butyl mercaptan, 0.355%. The liquid sodium must be mixed or filtered and recycled in order to avoid contamination with by products. The effect of temperature is much more important than that of the quantity of sodium present in the apparatus.

2845 APTIC NUMBER 20511

FABRICATION FOR THE METHANE PROJECT. Welding Metal Fabric., vol. 32: 366-372, Oct. 1964.

The storage and transportation of LNG (liquefied natural gas) is examined with emphasis on the welding and metal fabrication techniques employed in constructing storage tanks and specialized cargo vessels. Details are given of techniques used in constructing storage tanks at Canvey Island, Great Britain, a 325-mile distribution pipeline network from this installation, the LNG tanker vessels Methane Pioneer and Methane Progress, and the storage tanks of the CAMPL liquefaction plant at Arzew, Algeria. Mention is also made of the LNG distribution terminal at Le Havre, France, and the French LNG tanker Jules Verne.

2846 APTIC NUMBER 21147

Wells, Michael J.
ESSO IN LIBYA- ATSHAN TO GAS EXPORT. World Petrol., 38(3):80-82, 85, March 1967.

The total production capacity of a Libyan oil-producing area will soon reach 635,000 b/d. To achieve a high degree of economy, ease of operation, and smoothness of metering control, separators and treating and pumping equipment for several fields are located at a central facility. Several gas-oil-water separation plants are provided, two of which have three banks of first- and second-stage separation plus one test bank, while the other has two separator banks. First-stage separation is at 180-200 psi and second stage at 65-75 psi. In the latter stage, a chemical is injected to break the mulch, a flow spreader then brings the crude oil to the dehydration unit/heater treater for free water knockout at 30-35 psi. The oil then goes to three surge tanks, each with a capacity of 55,000 bbl, which act as third-stage separators. It is pumped through meter tanks and on to a shore terminal, where it is loaded onto tankers by bow-mooring. A new liquefaction plant under construction adjacent to the terminal will be the world's largest. Gas from the area will be refrigerated at -295 F and shipped to Italy or Spain in 250,000 bbl tankers at an initail 345 million cu ft daily. Wet field gas will be transported to the liquefaction plant through a 36-in diameter pipeline after compression to 720-psig.

2847 APTIC NUMBER 20741

Welty, Albert B. Jr., Russell M. Johnson, and Glenn A. Atwood
PROCESS AND APPARATUS FOR THE CONVERSION OF SO2 IN FLUE GAS TO SULFUR. (Esso Research and Engineering Co., Linden, N. J.) U. S. Pat. 3,476,513. 4p., Nov. 4, 1969. 12 refs. (Appl. Aug. 25, 1966, 6 claims).

An improved process is described for the conversion of sulfur dioxide in flue gas to elemental sulfur, which relates to the production of hydrogen sulfide for use in the Claus reaction wherein SO2 is reacted with H2S to produce sulfur. The invention comprises dividing the flue gas into a major portion of about two-thirds of the gas and a minor portion of about one-third, while the division is made at a point where the flue gas is leaving the combustion zone and has a temperature of 2000-3000 F. A hydrocarbon vapor which will burn without making smoke at the low oxygen concentration prevailing in this part of the furnace is added to the isolated major portion, and a sufficient amount is added to consume the excess oxygen used in the primary combustion and to place the gas slightly on the reducing side that subsequent equilibration over catalyst at a lower temperature will convert essentially all of the SO2 to H2S. This gas is cooled to 1000-1600 F in the superheater section of the furnace, and passed over a catalyst which reacts hydrogen and carbon monoxide with sulfur dioxide to form hydrogen sulfide, water, and carbon dioxide; this is further cooled to about 600-900 F. The H2S-containing stream is then mixed with the minor portion of the gas, and the SO2 and H2S are cooled and reacted to produce sulfur. Conversion to sulfur and the removal of the sulfur from the catalyst are carried out in a raining solids type reactor and a transfer line regenerator in one method and in a transfer line reactor and a raining solids type regenerator in another method.

2848 APTIC NUMBER 21009

Wiemer, Jean
ELECTROSTATIC DUST PRECIPITATOR. (Metallgesellschaft A. G., Frankfurt (W. Germany)) U. S. Pat. 3,483,671. 4p., Dec. 16, 1969. 8 refs. (Appl. Dec. 1, 1967, 2 claims).

By using electrodes with different discharge characteristics, a vertical electrostatic dust collector is achieved with a considerable reduction in the collector size, high tension power line, and investment costs. The spark or discharging electrode hung in the tabular or pipe-type collecting or precipitating electrode is made, in the direction of gas flow through the precipitator, strongly discharging in the first third of its length, moderately discharging in the second third, and non-discharging in the last third. This causes both coarse and fine dust particles to be precipitated from the gas at a greater efficiency. In a modification form, the discharge electrodes are formed of round rods which have discharge points in approximately the first third of their length, and in the second third have discharge lugs or shorter spikes. (Author abstract modified)

2849 APTIC NUMBER 20474

Wiley, Joseph B., Jr.
HIGH PERFORMANCE WIRE CLOTH FILTERS. Hydraulics Pneumatics, 20(9): 129-131, 133-134, 167, Sept. 1967.

Design criteria on high performance wire cloth filters are discussed for application to aerospace ground equipment systems, especially those involving cryogenics and high pressure pneumatics. Particle stoppage rates of such filters range from the sub-micronic to 200 micron, with most requirements from one-half to 10 micron nominal for hydraulic, cryogenic, and corrosive fluids and gases. Many critical applications are at pressures from 3000 psi and up. Inline filters require complete removal of the housing from the line, while an element-removable filter can be welded to its connecting piping. The relation between contaminant capacity and flow/pressure drop in the filter element is reviewed, as well as systems which involve continued contaminant buildup. A margin of safety should be provided with extra contaminant holding capacity. High quality stainless steel wire cloth makes the best re-usable element. Wire cloth lends itself to pleating or forming to increase filtration area within a cylindrical form of given dimensions; the pleat form itself is of great importance. The wire cloth must be annealed at temperatures as high as 2300 F before fabrication of element sections. The longitudinal seam must be a complete bond using the least possible effective filtration area and in which there is no possibility of leakages. A reinforcing core inside the cloth bundle provides mechanical strength to the element assembly. A completely fail-safe element will withstand rupture beyond the minimum collapse pressure, even when it is actually flattened.

2850 APTIC NUMBER 20716

Wilford, Edward Burke
INTERNAL COMBUSTION ENGINE. (Assignee not given.) U. S. Pat. 3,475,905. 5p., Nov. 4, 1969. 6 refs. (Appl. Jan. 23, 1967, 5 claims).

A method is described which improves the efficiency of an internal combustion engine at part throttle and reduces the toxicity of the exhaust gases, smog, and solids, by achieving more complete combustion. This is effected by eliminating the carburetor throttle valve on the intake manifold, installing a throttle valve in the exhaust manifold, and maintaining the exhaust manifold at an elevated temperature (700-1100 F). Such temperature is maintained by means of an insulating shroud wherein cooling air is normally blocked and only selectively admitted by operation of a shutter which is thermostatically actuated by sensing the temperature within the exhaust manifold. (Author abstract modified)

2851 APTIC NUMBER 20638

Wilki, John
CLEANING DEVICES FOR GAS FILTERING APPARATUS. (Assignee not given.) U. S. Pat. 3,498,030. 5p., March 3, 1970. 13 refs. Appl. Nov. 1, 1967, 1 claim.)

A reverse flow cleaning device for air or gas filtration apparatus comprises a high pressure air or gas inlet pipe, a moveable hollow casing suspended over a filter bag chamber, and suspension means for the casing. When high pressure air or gas is injected into the casing, the casing contacts the filter chamber outlet, inducing a flow of filtered air or gas into the filter bag for reverse flow cleaning of the medium. The reverse flow cleaning dislodges solids from the filter bag surfaces to the bottom of the filter chamber for subsequent removal. The invention can be applied to a filter chamber defined in part by several bag filters connected to a common manifold. Continuous air filtration can be achieved in an apparatus having more than two filter chambers if each of the filter chambers is cleaned, in turn, while the others remain in gas filtering service. The filter bags can extend upward or at any other convenient angle. The axes of the reverse flow cleaning devices must be aligned with the filter chamber outlets, but need not coincide with or be parallel to the axes of the filter bags. Almost any available source can be used for the high pressure air. An advantage of the cleaning device is that it can be optimized without interference with the normal flow path of filtered air through the air filtering apparatus.

2852 APTIC NUMBER 21197

Willis, Robin Burke, David Lloyd George Beattie, and Ferris George Swann
CYCLONE SEPARATOR. (Porta-Test Manufacturing Ltd., Edmonton (Alberta)) U. S. Pat. 3,481,118. 8p., Dec. 2, 1969. 20 refs. (Appl. April 22, 1968, 6 claims).

A centrifugal separator is described particularly suitable for the separation of large quantities of liquid from gas. It consists of a vertical, cylindrical, cyclone-type, hollow separator vessel, divided into an upper liquid-gas separation chamber and a lower liquid collection chamber by a horizontal baffle plate. Liquid

may move from the upper chamber into the lower chamber through a gap defined between the outer edge of the baffle plate and the vessel wall. A vortex finder extends into the separation chamber for gas removal. The vortex finder is formed of two spaced, longitudinally aligned sections which define a gap between them. This gap is connected with a central opening in the baffle plate by a closed conduit. In operation, the low pressure zone located at the centre of the gas vortex causes suction to be exerted at the gap so as to recover liquid entrained in gas leaving through the vortex finder and return it to the separation chamber. (Author abstract modified)

2853 APTIC NUMBER 21269

Wilm, Diederich, Willi Flasskamp, Eduard Broft, and Kurt Jordan
APPARATUS FOR SEPARATING SOLID MATTER FROM AEROSOL SUSPENSIONS. (Deutsche Gold- und Silber-Scheideanstalt vormals Roessler (West Germany)) U. S. Pat. 3,473,300. 4p., Oct. 21, 1969. 9 refs. (Appl. Feb. 6, 1968, 2 claims).

Aerosol suspensions carrying fine dust have heretofore been sent through a centrifugal separator and then through two or more filter chambers. The special filters for the removal of lightweight solid matter have disadvantages because of the high temperatures of the dust-laden aerosol suspension. Customary web filters cannot withstand such high temperatures. A device is presented for separating particulates from aerosol suspensions where the raw gas is first cleaned of coarse matter in a number of centrifugal separators and then passed into web filter chambers for final cleaning. Clean gas from the filters rinses the filter chambers and recycles dirty gas back to the separators. Mechanical and chemical stresses on the filter webs can be avoided by maintaining a constant gas pressure and temperature within the device.

2854 APTIC NUMBER 21303

Wilson-Jones, R. A.
ENGINES. Automobile Engr., 60(6):200-210, May 8, 1970.

The technology available to restrict automobile-caused pollution is reviewed. To meet current legislation, attention has been turned from minor modifications to further refinements in induction and ignition systems. The concensus in design is toward the V-type engine; several significant new V-types have recently been announced. The Wankel engine is being increasingly used. Its advantages are small size and weight for a given output. Fuel injection systems are increasing due to high costs for modified carburetors. Fuel will probably be lead-free in the near future. The development of complex anti-emission equipment such as exhaust recirculation devices and thermal and catalytic reactors is of prime importance in pollution control.

2855 APTIC NUMBER 21427

Winter, Karl
PROCEDURE AND EQUIPMENT FOR THE REMOVAL OF COMBUSTIBLE VAPOROUS AND GASEOUS POLLUTANTS FROM A STREAM OF AIR OR GAS. (Verfahren und Vorrichtung zur Reinigung eines Luft-oder Gasstromes von verbrennbaren dampf- oder gasfoermigen Verunreinigungen). Text in German. (Concordia Elektrizitaets A. G., Dortmund (West Germany)) Swiss Pat. 468,847. 5p., Feb. 28, 1969. (Appl. July 1, 1968, 2 claims).

A method for cleaning air or gas flows from combustible vaporous or gaseous pollutants was devised making use of sorption filters. The filters contain activated coal for adsorption of the pollutants. The loaded filter is counter-currently desorbed with heated air. The desorbate is burned and part of the mixture of air and burned desorbate is passed through the filter until it can be reused again for further pollutant sorption. Two filters are used alternately in the process. The desorbate is burned in a catalytic afterburner. The equipment comprises a mixing chamber controlled by an oxygen measuring device, a ventilator, a heater contolled by a temperature sensor, and a contact chamber. The filters are separated from the desorption and combustion circuit by a pair of valves. The ventilator passes the gas flow to the filters for cleaning. The contact chamber hold catalysts for combustion of the gaseous or vaporous pollutants.

2856 APTIC NUMBER 21060

Woodhead, Frederick Ashworth
METHOD FOR COOLING HOT WASTE GASES AND APPARATUS FOR CARRYING IT OUT. (Procede pour refroidir des gaz de dechet chauds et appareil pour sa misc en oeuvre). Text in French. (Simon-Carves Ltd., Stockport (England)) Swiss Pat. 467864. 3p., Jan. 31, 1969. (Appl. Dec. 22, 1966, 3 claims).

In the conversion of pig iron into steel, carbon, phosphorus, silicon, and manganese are oxidized by blowing oxygen through the molten charge. The oxidation products which emerge are slag and waste gases containing carbon oxides and suspended particles of iron and calcium oxides. To reduce the dust content of the hot waste gases economically, they must be cooled before being passed through an electrostatic precipitator. The present invention concerns a procedure for cooling these gases first through an indirect-contact heat exchanger and then through another exchanger cooled by a current or air driven by a blower in an enclosure. The heated air leaving the second heat exchanger is discharged into the atmosphere. Another procedure uses an expansion tank in which the water and steam produced by heating in the first exchanger are separated; the stream is passed through the second heat exchanger where it condenses, and the condensate is returned to the expansion tank where it is mixed with the separated water fraction from the first heat exchanger; this mixture is returned to the first heat exchanger.

2857 APTIC NUMBER 21608

Worley, M. S.
NEW TREATING TECHNIQUES IMPROVE SOUR-GAS PROCESSING. J. Petrol. Technol., vol. 13:976-982, Oct. 1961. 19 refs. (Presented at the Natural Gas Processors Association Meeting, Calgary, Alta, April 6, 1961.)

Hydrogen sulfide and sulfur dioxide gases vented by sour gas wells are a source of danger and discomfort to nearby residents and also adversely affect domestic animals, vegetation, and buildings. The sour liquid condensate produced with these gases adds to the air pollution problem. However, new wellhead conditioning techniques allow almost all of the hydrogen sulfide normally ventilated in wellhead conditioning operations to be kept in the gas line. The sour condensate can be dehydrated at high pressure or it can be stabilized and sweetened for atmospheric storage. In either event, the hydrogen sulfide and light hydrocarbons are reclaimed. Three basic stripping techniques are discussed and schematically illustrated. Condensate dehydration is also being employed in sweet gas applications. It is frequently considered where gas dehydration is performed in remote and cold climates or on offshore platforms. Due to improvements in glycol dehydration techniques, it is now possible to obtain dew point depressions of 140 F. An equilibrium curve is presented that accurately indicates the maximum dew point depression possible with triethylene glycol at varying concentrations and at the pressures encountered in field operations. In the past, hydrogen sulfide and carbon dioxide were removed from natural gas by ethanol amines. Today, a variety of synthetic absorbents are available. These 'synthasorbs' employ physical absorption rather than chemical reactions to utilize the full driving force of the high-pressure acid gases to reduce the absorbent flow rate. In addition, they require much less energy to release the absorbed gases after reduction to atmospheric pressure. Furthermore, the use of a physical absorbent solution implies chemical inertness that should substantially reduce the cost of treating chemicals lost be nonregenerative chemical reactions.

2858 APTIC NUMBER 21288

Wuestefeld, Aloys and Georges Weber
DEVICE FOR SEPARATING SOLID PARTICLES FROM A GAS FLOW. (Einrichtung zum Abscheiden fester Partikeln aus einem Gasstrom). Text in German. (Pentron Establishment Schaan (Liechtenstein)) Swiss Pat. 470,194. 4p. March 31, 1969. (Appl. Feb. 2, 1968, 6 claims).

A device is described for simultaneous separation of coarse and fine dust particles from a gas flow. It consists of a vertical casing with an inlet pipe on the bottom and an outlet pipe on top. Inside the casing, a filter consisting of vertical plates is installed. Horizontal plates block the filter in a vertical direction. A cyclone with impaction plates precedes the filter. Underneath this cyclone chamber is the dust collector. The coarse particles are separated ahead of the filter. A downward air flow cleans the filter plates of adhering dust. The cleaning effect can be enhanced by an adsorbing agent such as asbestos, glass fiber, plastic fiber, etc. in the cyclone chamber. The casing may be of square or rectangular shape narrowing conically toward the inlet. The top of the separator may be either formed by a horizontal plate or by walls conically narrowing toward the outlet.

2859 APTIC NUMBER 20272

Yamanouchi, M., Y. Sakata, and H. Okada
DIESEL SMOKE SUPPRESSION BY FUEL ADDITIVES. (Diesel kokuen no tenkazai ni yoru hokusei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):90, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Small diesel engines being used for automobiles mainly consume light oil as fuel, but they pose the problem of emitting black smoke from the exhaust. It has been reported that the addition of some barium compound reduces the emissions effectively. Barium compounds were added to light oil and tested in the experimental furnace and diesel engine, and were indeed found to be effective. The addition of barium compounds to light oil and the subsequent tests run on several different types of diesel engines demonstrated that in every case, the 0.25 - 0.5% (by volume) of barium compound in light oil lowered the black smoke emission of Boc No. 5 - 6 down to about Boc No. 1 - 3.

2860 APTIC NUMBER 21040

Yarrington, Robert M. and William E. Bambrick
DEACTIVATION OF AUTOMOBILE EXHAUST CONTROL CATALYST. J. Air Pollution Control Assoc., 20(6):398-401, June 1970. 10 refs.

A catalytic converter for controlling automobile exhaust emissions was evaluated in California in 1964. Results of this fleet test and subsequent analysis of the spent catalyst are presented. Statistical analysis of dynamometer test indicates a strong effect of tetraethyl lead content of the gasoline on activity decline. Analysis of spent catalyst revealed that both surface area and accumulated lead are major factors in activity decline. At above 100 sq m/g, a further increase in surface area at constant lead level resulted in a decline of activity. (Author abstract)

2861 APTIC NUMBER 20262

Yoshinochi, Shuntaro and Kazumi Kamei
DAP-MN PROCESS FOR DESULFURIZATION OF FLUE GAS. Chem. Economy Eng. Rev., 1970:22-25, March 1970.

Research and development of an activated manganese oxide process (DAP-Mn) for removing sulfur dioxide from flue gases of large oil-fired power plants are described. Powdery activated manganese oxide is uniformly dispersed in the gas at the inlet of an absorber and carried along with the gas stream. The SO2 and SO3 in the flue gas react with the absorbent to form manganese sulfate. The reacted manganese sulfate and unreacted manganese oxide are collected after being separated from the gas stream by a

multicyclone and electric precipitator. The activated manganese oxide is regenerated, and an ammonium sulfate solution is obtained, by treating the separated manganese sulfate solution with ammonia and air. Next, the regenerated manganese oxide is liberated from the ammonium sulfate solution and recycled to the circulation system. Other by-products that can be recovered are gypsum and phospho-ammonium sulfate. Since flue gas is introduced to the absorber without pre-treatment, the method does not require boilers to be remodelled. Neither do absorbers or regenerators require special heat-or corrosion-resistant materials. The treated gas is kept above 110 C. In pilot-plant studies, the method removed 90% of the SO2 from flue gas with a SO2 concentration of 0.1 vol%.

2862 APTIC NUMBER 20574

Tushkevich, N. F., V. A. Karzhavin, A. V. Avdeyeva, and Yu. P. Nikol'skaya
OBTAINING SULFUR FROM SULFUR DIOXIDE. VIII. REACTION OF SULFUR DIOXIDE WITH HYDROCARBONS. (Polucheniye sery iz sernistogo gaza. VIII. Vzaimodeystviye sernistogo angidrida s uglevodorodami). Text in Russian. Khim. Prom. (Moscow), 11(2):33-37, 1938. 8 refs.

The reaction between sulfur dioxide and methane at 900 C in the presence of bauxite catalyst proceeds at a practical volumetric rate. Reduction of SO2 proceeded faster with petroleum distillate vapor than with methane, reaching industrially practical rates at 700-800 C. These reactions are seen as a promising approach to the production of sulfur from various SO2-containing gases (generator gas, coke gas, natural gases, and gases obtained by distillation of shale and by petroleum pyrolysis).

2863 APTIC NUMBER 20601

Zeller, Helmut, Andreas Mueller, and Klaus-Dieter Neumann
FLOW CONDITIONS IN ELECTROSTATIC PRECIPITATORS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(8):1-6, Aug. 1969. 3 refs.

Model tests in dust-free flows and dust-laden flows were conducted to determine the geometry of collecting electrodes which would be suitable from the point of view of flow technology in electrostatic precipitators. The dust-free flows indicated that certain shapes of collecting electrodes favor dust deposition by causing the formation of dead-water between the elements fitted to the electrodes; they prevent contact and subsequent detachment of the flow from the wall for deposited particles by wall flushing. The simulation of dust movement (due to Coulomb forces in the precipitator) by the motion of vestiron spheres in a water channel under the influence of the gravitational field confirmed these results. (Author conclusions modified)

2864 APTIC NUMBER 21504

Zentgraf, K. M.
INDUSTRIAL-SCALE TESTS OF THE DESULFURIZATION OF SMOKE. (Prove su scala industriale per la desolforazione dei fumi). Text in Italian. Riv. Combust., 22(7-8):402-408, 1968. (Presented at the Conference on Le grandi centrali termoelettriche e nucleari ed i problemi dell'inquinamento atmosferico, Rome, Italy, April 4, 1968.)

Results are presented of comparative, semi-industrial scale tests of four methods of desulfurizing heating plant smoke. The methods are additives and the Reinluft, Still, and Mischoff processes. For the Reinluft process, which uses adsorbents, efforts are under way to find the most suitable of easily available materials, e.g., lignite coke instead of the original peat coke. The other three processes use powdered limestone, lime, and calcium hydrate for which substitues are also being investigated. There is also difficulty in handling the process tail products; for instance, disposal of the residue to obtain saleable by-products is a question that cannot always be easily decided. The special advantages attending each process are described, and costs are given for the Reinluft and Still processes. (Author abstract modified)

2865 APTIC NUMBER 20751

Zimmermann, Martin Richard
APPARATUS FOR THE RECOVERY OF SOLVENTS FROM THE AIR. (Assignee not given.) U. S. Pat. 3,486,305. 4p., Dec. 30, 1969. 4 refs. (Appl. Nov. 27, 1967, 9 claims).

The formation of poisonous phosgene gas occurs in steam generators when particles of activated charcoal containing halogenated solvents, such as per- and trichloroethylene, are heated well above 100 C. If this reaction is to be prevented, contact must be avoided between the particles falling out of the filter chamber and the hot surfaces of the generator. The invention protects the heating surfaces against direct contact with falling particles by a twin arrangement of activated charcoal units acting alternately to adsorb the solvent from the air and to desorb the solvent. Both units are alternately switched in the flow of steam from a common generator provided for the desorption on the one side and on the other side with a condensor for subsequent separation of the flushing stream and solvent. A fall chamber extends from each filter chamber to the steam generator. The fall space is free of heating surfaces. Thus not only descending droplets of condensate but also the activated charcoal particles are immersed in the water of the generator so they cannot be subjected to dangerously high temperatures.

2866 APTIC NUMBER 21477

CHEMICAL BLANKET GUARDS LNG PLANT. Am. Gas Assoc. Monthly, 48(6):8-10, 18, June 1966.

A fire extinguishing system with a capacity of 30,000 pounds of dry chemical and 40,000 gallons of water is described. The system protects an in-ground liquefied natural gas storage tank with a capacity of 300,000 barrels of LNG. The system is capable of delivering all 30,000 pounds of its sodium bicarbonate base dry chemical onto and into the tank in one minute. Double redundancy is incorporated into the activation systems permitting activation automatically, by manual-electric means, and manually in a power-down situation. The extent of protection is required both by reason of the volume of gas involved and by its location at Carlstadt, New Jersey, only half-a-dozen miles from midtown New York City.

MEASUREMENT METHODS

2867 APTIC NUMBER 20605

Al'perin, V. Z., V. N. Zasukhin, R. N. Sayfi, and Ya. M. Chernin
AUTOMATIC GAS ANALYZER FOR CONTINUOUS MONITORING OF SULFUR DIOXIDE IN ATMOSPHERIC AIR. (Avtomaticheskiy gazoanalizator dlya neprerynogo opredeleniya sernistogo gaza v atmosfernom vosdukhe). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no. 234:175-180, 1968. 9 refs.

A new conductometric instrument for measuring sulfur dioxide concentration, called the Pikoflyuks, is described. It is distinguished by incorporating self-contained heaters for winter operation. It has three sensitivity ranges (0-1, 0-2.5, 0-5 mg SO2/cu m) with an error of plus or minus 5%. Both rack and portable models are produced. Another device, the GKP-1 coulomb-polarographic gas analyzer, designed for continuous monitoring of SO2 in atmospheric air is described in detail. It is based on an electrochemical technique which utilizes excess iodine to react with the SO2 yielding HI which is then quantitatively oxidized on a measuring electrode. This instrument has four measurement ranges (0-1, 0-2, 0-5, 0-10 mg SO2/cu m), is heated, and capable of operating at temperatures to -40 C with a fundamental error of plus or minus 6%.

2868 APTIC NUMBER 21090

Al'shits, I. M., T. A. Anikina, E. A. Babenkova, and N. M. Grad
DETERMINATION OF STYRENE AND CUMENE HYDROPEROXIDE IN THE AIR WHEN THEY ARE PRESENT TOGETHER. (Opredelenie v vozdukhe stirola i giperiza pri ikh sovmestnom prisutstvii). Hyg. Sanit., 29(9): 64-67, Sept. 1964. 5 refs.

Comparative data were collected on the sensitivity of several methods for determining styrene and cumene hydroperoxide content in the air. A photoelectric colorimeter (PEK-M type with a blue no. 3 light filter) was used in all colorimetricc determinations. Of the known methods of determining styrene in air in the presence of cumene hydroperoxide, the simplest and most specific was the Ivanov procedure which is based on the colorimetry of yellow products of styrene transformation by concentrated sulfuric acid. Of the known methods of determining cumene hydroperoxide in air in the presence of styrene, the most sensitive and specific was the Alekseeva procedure which is based on the colorimetry of pink combination products of phenol and diazotized p-nitroaniine, obtained from the decomposition of cumene hydroperoxide by the action of concentrated sulfuric acid. Both methods are sufficiently sensitive and specific for analyzing room air containing mixtures of styrene and cumene hydroperoxide.

2869 APTIC NUMBER 20899

Aleksandrov, N. N., N. A. Panichev, M. A. Rzhaksinskaya, and Yu. I. Turkin
SPECTRAL METHOD OF DETERMINING A NUMBER OF ELEMENTS IN ATMOSPHERIC AEROSOLS. (Spektral'nyy metod opredeleniya ryada elementov v atmosfernykh aerozolyakh). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no. 234:196-204, 1968. 3 refs.

A method of spark discharge spectral analysis was used to measure the content of aluminum, iron, calcium, magnesium (relative concentrations of 0.1-10%), manganese, nickel, zinc, copper, and lead (relative concentrations of 0.01-1%) in samples of atmospheric aerosols. This method also detects trace amounts of chromium, beryllium, barium, and strontium. Such determinations, together with meteorological data, provides a means of identifying pollution sources and studying atmospheric diffusion.

2870 APTIC NUMBER 20315

Allen, Donald M.
CONSTANT-FLOW AIR SAMPLER. (International Chemical and Nuclear Corp., Burbank, Calif.) U. S. Pat. 3,501,899. 6p., March 24, 1970. 11 refs. (Appl. May 2, 1968, 3 claims).

The constant air flow sampling system automatically compensates for varying resistance to air flow and automatically corrects such compensation to constant temperature conditions. Discharge pressure is employed as a basis for control in the system. The filter apparatus includes a variable speed pump and a control motor connected to the pump to vary the rate of fluid flow. A valve is interposed between a pressure sensitive switch, which activates the motor and the pump outlet. This valve is responsive to the pump motor. (Author abstract modified)

2871 APTIC NUMBER 21012

Anderson, Floyd G.
A TECHNIQUE FOR COUNTING AND SIZING DUST SAMPLES WITH A MICROPROJECTOR. Am. Ind. Hyg. Assoc. J., vol. 23:330-336, July-Aug. 1962. 4 refs. (Presented at the American Industrial Hygiene Association Annual Meeting, 23rd, Washington, D. C., May 16, 1962.)

The use of a microprojector for counting and sizing airborne dust is described. The critical set-up of the apparatus and the illuminating system are outlined step by step. Particle counts at 1000X magnification may be made with samples collected with the midget impinger, membrane filter, or thermal precipitator. Particle size determinations are conveniently made at 10,000X. Advantages are greater speed and ease of counting, making possible sustained accuracy over a full workday. (Author abstract)

2872 APTIC NUMBER 20722

Archer, Lee A. and Russel S. Peterman
COMBUSTIBLE GAS DETECTOR APPARATUS. (Erdco Engineering Corp., Addison, Ill.) U.S. Pat. 3,484,773. 4p., Dec. 16, 1969. 3 refs. (Appl. Jan. 10, 1968, 9 claims).

A combustible gas detection apparatus is improved, making it

possible to separate the detecting and indicating modules by as much as two miles, reduce the cost of the apparatus and its operation, provide better means for calibration adjustments, and increase its accuracy and stability. The detector and reference filaments of the sensing head are respectively connected across the secondaries of a pair of identical step down transformers and are connected in series. Primaries of the transformers are connected in series and an adjusted voltage is continuously impressed across them to supply power to maintain the filaments at the desired high temperature. With the primary windings of the two transformers forming two legs, a Wheatstone bridge is completed by providing two additional resistance legs with connection to the midpoint between the transformer primaries. Arrangement is such that the balancing adjustments of the bridge also equalize the voltages impressed across the two filaments, respectively, and thereby equalize the normal temperatures of the filaments.

APTIC NUMBER 21345

2873

Hall, W. L., G. E. Moore, J. L. Monkman, and Morris Katz
AN EVALUATION OF MICRO-VACUUM SUBLIMATION SEPARATION OF ATMOSPHERIC POLYCYCLICS. Am. Ind. Hyg. Assoc. J., 23(3):222-227, May-June 1962. 13 refs.

A micro-vacuum sublimation technique was studied for the separation of polycyclic hydrocarbons from samples of atmospheric pollutants. This technique gives quantitative separation of pyrene from particulate samples directly and from the extracts of such samples. The efficiency of separation is of the same order as that of column chromatography, and sublimation is more rapid. Enrichment of extracts or residues from column eluates can be effected. (Author abstract)

APTIC NUMBER 20971

2874

Harrington, Alfred E.
ION MICROPROBE MASS SPECTROMETER. National Aeronautics and Space Administration, Cambridge, Mass., Electronics Research Center) U. S. Pat. Appl. 815,367. 21p., April 11, 1969.

An ion microprobe mass spectrometer for analyzing trace amounts of a fluid is described. A duoplasmatron ion source produces a primary beam which is advanced toward a target electrode by the focusing magnet and through an aperture formed in an anode. The beam is further formed and shaped by an electrostatic lens. A deflection means directs the beam obliquely onto the surface of the target electrode. The beam, directed to the sample layer causes a portion of the layer to be sputtered, producing a secondary beam which contains ionized sample material from the sample layer. A selective focusing means directs the relatively low charged ions of the beam into a mass analyzer for analysis. Trace amounts of a fluid may be analyzed by first cooling the surfaces of the target electrode. The electrode is refrigerated by introducing a suitable refrigerant into an in-out refrigeration line. Next, a sample of the fluid stream is introduced into a target chamber by a fluid line and directed over the cooled surface of the target electrode. As a result, a portion of the sample fluid is condensed onto the surface of the target electrode which solidifies and forms the sample layer. The target is cleaned by energizing the heating element so as to boil off the deposited material from the previous sample. Due to the unique construction of the spectrometer and its ability to both cool and heat, the target electrode may be maintained at any desired temperature; the device may be readily utilized too analyze a gas. The apparatus is expected to find extensive use in the chemical analysis of biological material. In addition, atmospheres taken from various sample areas, such as a space cabin, may be analyzed and the instrument employed as a trace contaminant analyzer.

APTIC NUMBER 21595

2875

Becker, K. H. and Kyle D. Bayes
CO CHEMILUMINESCENCE FROM FLAMES. J. Chem. Phys., 48(2):653-661, Jan. 15, 1968. 42 refs.
CFSTI, DDC: AD 677 976

The chemiluminescence for the reaction of oxygen atoms and carbon sub-oxide in a flow system has been reinvestigated. In additon to 'triplet' bands, two other band systems of carbon monoxide were observed: the Herman bands, also in the red, and the Fourth Positive bands in the vacuum ultraviolet. The three electronic states show a common excitation limit of almost 9 eV above the ground state. The emission intensity in the red and in the vaccum ultraviolet vary together as the flame conditions are changed, showing that the three excited states are formed in a single reaction. Traces of hydrogen are not necessary for the chemiluminescene. Quenching of the CO emission depends on the ratios nitric oxide/O and O2/O, with NO being a more efficient quencher than O2. The vacuum-ultraviolet emission from a O + C2H2 flame was found to be identical to that of the O + C3O2 flame. As required by the single-reaction hypothesis, the 'triplet' bands and probably the Herman bands were found in the spectrum of the O + C2H2 flame. Possible reactions which could form C2O in these flames are discussed. (Author abstract modified)

APTIC NUMBER 20886

2876

Bosch, Robert
METHODS TO MEASURE AIR POLLUTANTS IN EXHAUST GASES OF AUTOMOBILES WITH OTTO ENGINES. (Messverfahren in Bezug auf die Verunreinigung der Luft durch die Absase von Fahrzeugen mit Otto-Motoren). Doc. W/Trans/WP 29/252 of Jan. 16, 1968. 14p. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 24p., Sept. 22, 1969.

A method is proposed for measuring the amount of carbon monoxide and calculating the amount of hydrocarbons in exhaust gases from automobiles with Otto engines. In the method, which simulates driving conditions in heavy city traffic, the automobile is tested on a chassis dynamometer equipped with a brake and a flywheel. Four test cycles lasting a total of 13 min are performed without interruption. Each cycle consists of 15 operating stages (idle, acceleration, cruising speed, deceleration, etc.) in the course of which the exhaust gases are collected in one or more bags. At

the end of the sampling time, the gases are analyzed and their volume is measured. Formulas are presented for converting the amount of gas contained in each bag to standard temperature and standard pressure and for computing the amount of carbon monoxide and hydrocarbons in each bag.

2877 APTIC NUMBER 20317

Brand, Ernest K. Von
ANALYTICAL APPARATUS AND METHOD FOR INSTANTANEOUS RECORDING AND READING CONTAMINANTS IN FLUENT MATERIALS. (Assignee not given.) U. S. Pat. 3,495,439. 5p., Feb. 17, 1970. 5 refs. (Appl. April 6, 1966, 10 claims).

An apparatus and method are described which obtain an instantaneous and continuous reading and permanent record of contaminants in a fluid, such as solids in air. The device utilizes a filter tape which continuously moves across a predetermined flow path of the fluid to be analyzed. The contaminants are deposited on the filter tape as a permanent record. A light source is mounted in longitudinal allignment with the intersection of the path of the filter tape and the flow path of the fluid. A photocell instantaneously and continuously senses the light reflected from the filter tape at the intersection. The quantity of light sensed is proportional to the quantum of contaminant deposited on the filter tape at the intersection. (Author abstract modified)

2878 APTIC NUMBER 21690

Braymen, D. T. and J. H. Songer
METHOD FOR QUANTITATING FORMALDEHYDE GAS IN AIR. Appl. Microbiol., 19(6):1021-1022, June 1970. 2 refs.

Vaporized formaldehyde is one of the most widely used gaseous disinfectants. The temperature, relatively humidity, and exposure time can be controlled, but vapor concentration is usually estimated from the amount of Formalin or paraformaldehyde vaporized. A method is described which measures the vapor concentration at any time during the exposure period. A 20-ml amount of a molar solution of sodium sulfite and three drops of indicator were placed in all-glass impinger air samplers and neutralized by titration with 1 N sulfuric acid. The sampler outlet was connected to a vacuum source giving at least 380 mm Hg. The sampler inlet was connected to a hose leading into the space to be sampled. The impinging fluid was titrated with 1 N H_2SO_4. One ml of acid was equivalent to 0.03003 g formaldehyde. The method is based on the quantitative release of sodium hydroxide when formaldehyde reacts with sodium sulfite to form a formaldehyde-disulfite addition product. The formaldehyde in the sample was determined by the equation: (ml of acid) (normality) (0.03003) equals g of formaldehyde/air sample. Deviation with this method is not more than 0.2 g/ cu m of formaldehyde. By combining this method with an air sampling procedure, a practical, reproducible quantitati.. method for formaldehyde in air resulted.

2879 APTIC NUMBER 21426

Breuer, W.
A NEW UNIT FOR AUTOMATIC ANALYSIS OF GASEOUS AIR POLLUTANTS. (Eine Neuentwicklung zur automatischen Analyse gasformiger Luftverunreinigungen). Text in German. VDI (Ver. Deut. Ingr.) Ber., no. 149:203-211, 1970.

An electrochemical detector for gaseous air pollutants is described. It consists of a solid organic electrolyte and silver electrodes. The operating principles are explained on a relatively simple hydrogen sulfide measurement. The two uniform silver electrodes enclosed at some distance in the solid organic electrolyte are connected with each other at low-ohmic impedance through the instrument and the amplifier. A number of mobile Ag(+) ions are continuously present in the electrolyte due to the dissociating effect of the latter. The H_2S in the gas flow reacts at the phase boundary gas- electrolyte - electrode and forms with the free silver ions silver sulfide. At this reaction, H(+) ions are liberated. They diffuse to the opposite electrode where they receive electrons liberated by dissolving Ag(+) ions. The electrons move through the outer circuit to the opposite electrode. The current is a measure for the number of H_2S molecules participating in the reaction. The detector can be installed together with the membrane pump and the selective filters for separation of interfering substances into a small unit. It can be designed for the measurement of different types of pollutants. An absolute quantity of 10 to the minus 11th power g H_2S could be be measured with a standard deviation of 6%.

2880 APTIC NUMBER 21025

Brockhaus, A. and K.-H. Freidrichs
THE MEASUREMENT OF PARTICULATE EMISSIONS. (Die Messung partikelformiger Immissionen). Text in German. VDI (Ver. Deut. Ingr.) Ber., no. 149:198-203, 1970. 7 refs.

Aerosol concentrations in the atmosphere are quite low, varying a great deal locally and temporally, that their measurement is difficult. Moreover, they are so heterogeneous and may include droplets, irregularly shaped particles and agglomerates of liquid and solid components. Separate measurement of dust and liquid particles does not seem to be feasible. The relatively high vapor pressure of water can be used for separation of the aqueous particles, but the solid particles are lost in the process. Of the three parameters concentration, particle size distribution and qualitative composition, very few studies have been done of the second one. Concentration is measured by optical or gravimetric methods, with the more sensitive optical approach particularly suited to the measurement of short-term concentration fluctuations. Gravimetric methods require long sampling periods and a high air input. Frequently both methods are used for aerosol determination. The mass concentration of particulate matter has been measured with high volume air samplers. The error margin of these units is + or - 21.6 microgram/cu m., while for a cyclone apparatus an error margin of + or - 4 microgram/cu m was determined. Measurements in industrial centers over several years are tabulated and indicate no tendency of the fine particle fraction to decrease in quantity.

2881 APTIC NUMBER 21629

Buck, H.
DEVELOPMENT AND TESTING OF A FILTER CARTRIDGE FOR THE ELIMINATION OF DISTURBING INFLUENCES AT THE MEASUREMENT OF SULFUR DIOXIDE IN THE ATMOSPHERE. (Entwicklung und Pruefung einer Filterpatrone zur Ausschaltung von Stoerenflussen bei der Messung von Schwefeldioxid in der Atmosphaere). Schriftenreihe Landesanstalt Immissions- und Bodennutzungsschutz Landes Nordrhein-Westfalen (Essen), no. 6:28-30, 1966. 4 refs. Translated from German. Belov and Associates, Denver, Colo., 10p., April 15, 1970.

A filter cartridge based on the suction principle and consisting of a layer of quartz wool prepared with a solution of Ag2SO4 and KHSO4 was developed to absorb hydrogen sulfide, hydrogen chloride, and ammonia, the substances which interfere most with air quality measurements of sulfur dioxide. The cartridge absorbs the interfering compounds during sample intake almost completely at air throughputs of up to 180 liters an hour without also absorbing the SO2, and is therefore suitable for automatic SO2-measuring devices operating on low air throughput as well as for manual methods. Experiments are reported investigating in further detail the suction of H2S in the filter cartridge and SO2 uptake by the cartridge. When conventional sampling techniques are used for the Silikagel and TCM methods of manual SO2 measurements, SO2 values are not distorted by the filter. Instructions are given for its preparation and installation in the sampling device.

2882 APTIC NUMBER 20950

Bufalini, J. J.
GAS PHASE TITRATION OF ATMOSPHERIC OZONE. Environ. Sci. Technol., vol. 2:703-708, Sept. 1968. 10 refs.

A project to modify a Mast oxidant analyzer to be specific for ozone is described. The apparatus which incorporates a small gas reaction chamber on the analyzer, is slightly larger than the Mast instrument; field application is not affected by this system. Ozone is selectively removed from a gas stream containing a variety of oxidants by gas titrating with trans-2-butene. Observed values agreed well with the theoretically predicted value of a 98% reaction for the ozone. The reaction can be driven to greater completion by increasing the olefin concentration in the system. Possible interferences from hydrogen peroxide, n-butyl hydroperoxide, peroxyacetyl nitrate, nitrogen dioxide, and peracetic acid are discussed. Other oxidant analyzers can be similarly modified; in doing so, care must be taken to keep the residence time of the gases in the reaction chamber to a reasonable time so reaction is near completion.

2883 APTIC NUMBER 20987

Burns, M. S.
DETERMINATION OF PYRITIC SULPHUR IN AUSTRALIAN COALS. Fuel, 49(2): 126-133, April 1970. 18 refs.

The British Standard method for the determination of pyrite sulfur in coal is based on the assumption that pyritic iron is insoluble in hydrochloric acid but soluble in nitric acid, and that the iron soluble in hydrochloric acid is also soluble in nitric acid. A thorough investigation into this method showed that it is not suitable for all Australian coals, and that a direct (or nonsimultaneous) method should be adopted. Coal residue from the hydrochloric acid extraction is extracted with nitric acid. The iron removed by nitric acid under these circumstances gives the pyrite content of the sample directly. For a majority of the Australian coals tested, the proportion of the iron which was not extractable was generally less than 0.1%, indicating that the iron is essentially nonpyritic. Since most of the iron insoluble in nitric acid is nonpyritic, crushing to -300BS to release possible finely disseminated pyrite (as proposed in the revised British Standard method) is not necessary.

2884 APTIC NUMBER 21672

Byers, D. H. and B. E. Saltzman
DETERMINATION OF OZONE IN AIR BY NEUTRAL AND ALKALINE IODIDE PROCEDURES. Am. Ind. Hyg. Assoc. J., vol. 3:251-257, Feb. 1958. 11 refs.

Application of neutral and alkaline iodide reagents to the determination of low concentration of ozone was investigated. One percent potassium iodide in neutral buffered or alkali solutions was found to be more stable and useful than 20% KI for the collection and analysis of ozone in air. Either may be used to determine low concentrations. Over the range of 0.01 to 10 ppm ozone, results by the alkaline procedure should be multiplied by 1.54 to correct for stoichiometry. The neutral reagent has the advantage of not requiring an extra acidification step and of more nearly uniform stoichiometry. The alkaline procedure is preferable when final analysis may be delayed for any considerable period. Experiments with boric acid for acidification of samples in the alkaline reagent indicate that some mechanism other than oxidation of iodide to iodate or periodate is involved in this procedure, such as possibly formation of hypoiodate. Data from experiments with gas phase titrations of nitrogen dioxide and nitric oxide against ozone confirm the stoichiometry of the neutral reagent to be one mole of iodine released for each mole of ozone. (Author summary modified)

2885 APTIC NUMBER 21371

Channell, James K. and Roy J. Hanna
EXPERIENCE WITH LIGHT SCATTERING PARTICLE COUNTERS. Arch. Environ. Health, 6(3):386-400, March 1963. 6 refs. (Presented at the 27th Annual Meeting of the Industrial Hygiene Foundation, Pittsburgh, Pa., Oct. 24-25, 1962.)

A Royco Model PC 200 A Particle Counter, designed primarily for continuous monitoring of clean room atmospheres, and an aerosol photometer were evaluated for accuracy of counting and sizing

particles. In the first instrument, light from a microscope lamp is scattered by particles to a photomultiplier tube from which electronic impulses are fed into electronic circuits for amplification and then to a scaling circuit for counting. The PC 200 A was tested with polystyrene latex spheres and the following industrial dusts: Portland cement, milled natural and flux-calcined diatomaceous earth, iron dust, and coal dust. The instrument gave a size frequency distribution closely related to results for microscopic analysis, although it usually indicated a smaller mean dust size and larger spread in size distribution. Particle counting in any channel above 2 micron was invariably higher than the companion count indicated by the size range for optical microscopy. If data comparable to microscopic data are desired, the PC 200 A should be calibrated for both counting and sizing, using the type of dust to be sampled. The aerosol photometer tested is a battery powered light scattering instrument containing counting and size-discriminating circuits and a dilution system. In underground metal mine tests, its counts were found to compare favorably with midget impinger results but not with membrane filter samples. With adequate calibration, the photometer should be capable of producing satisfactory size distributions.

2886 APTIC NUMBER 20503

Chapman, Robert L.
CONTINUOUS AIR POLLUTION MONITORS. Biomed. Sci. Instrum., vol. 1:59-61, 1963. (Proceedings of the First National Biomedical Sciences Instrumentation Symposium, Los Angeles, Calif., June 14-17, 1963.)

Automatic chemical reagent addition instruments, optical analyzers, and coulometric instruments are described for broad survey programs which are thought to ultimately help determine the effect of auto exhaust on the health of people in urban areas; to determine the optimum design for atmospheric sampling in the future; and to predict dosage levels to which people may be exposed and to which health effects may be related. The automatic chemical reagent addition instruments are used for the continuous determinations of nitrogen oxides, sulfur dioxide, and oxidants; their operation involves bringing an air sample in contact with a chemical reagent. In the case of sulfur dioxide, the reagent is a dilute solution of hydrogen perioxide containing a trace of sulfuric acid, and any increase in sulfuric acid content is detected as an increase in electrical conductivity. The reagent in the case of total oxidants is potassium iodide solution in which free iodine is released by any oxidizing gas in the air sample and determined by a simple colorimeter. Nitrogen dioxide is determined by the color produced in an acidic reagent containing an organic compound which combines with nitrogen dioxide to produce a dye, while nitric oxide is first passed through an acidified potassium permanganate scrubber to oxidize the NO to NO2 before being exposed to the reagent. The response speed of this type of analyzer is relatively slow, since time must be allowed for chemical reactions to take place and color to develop. Reflectance from filter paper on which samples of dust have been collected, light scattering by air suspended aerosol, or direct molecular spectral absorbance of gases in the visible, ultraviolet, or infrared regions may be used in air pollution work. The non-dispersive infrared gas analyzer is described as applied to the direct determination of carbon monoxide in the atmosphere, and the hydrogen flame ionization detector is modified to serve as a direct total hydrocarbon analyzer for air monitoring. In the coulometric instruments, a minute fuel cell is formed in which chemical energy is directly transformed to electrical energy sufficient to drive a galvanometer. These instruments have the advantage of including only one moving part, that being the small sample pump.

2887 APTIC NUMBER 20760

Chapron, Yves, Genevieve Paltot, and Henri Francois
METHOD FOR THE INSTANTANEOUS ANALYSIS OF OZONE. (Commissariat a l'Energie Atomique, Paris (France)) U. S. Pat. 3,498,838. 4p., Feb. 10, 1970. 2 refs. (Appl. Jan. 15, 1968, 1 claim).

A selective method of ozone determination is described that permits instantaneous quantitative analysis without interference from other compounds. The method consists of reacting ozone and oxygen catalytically by simple contact with an organic compound, such as an autoxidizable aldehyde, and in measuring the concentration of the ozonation product by amperometric titration. The organic product is chosen so that the oxidation product is a hydroperoxide, a peroxide, a peracid, or a soluble perester. The amperometric titration method is based on the proportionality of the diffusion current to the concentration of the electroreducible substance to be determined. Use is made of a cell in which the electrolytic solution is circulated. The cell comprises an indicator electrode and a counter-electrode which performs the function of a reference electrode. A constant voltage is applied between the two electrodes and is set at an appropriate value to attain the diffusion current. The method permits the continuous recording of the ozone content of the atmosphere or any gas which contains at least 5% oxygen.

2888 APTIC NUMBER 20435

Choudens, C. de
DETERMINATIONS OF SULFUR DIOXIDE AND HYDROGEN SULFIDE BY SPECTROPHOTOMETRY IN GASEOUS EFFLUENTS OF RECOVERY CALDRONS OF A SULFATE PASTE PLANT. Dosages de l'anhydride sulfureux et de l'hydrogene sulfure p spectrophotometrie dans les effluents gazeux de chaudieres recuperation d'une usine de pate au sulfate). Text in French. ATIP, 22(2):113-121, 1968. 18 refs.

A method of removing and recovering gas samples in the flue gas of a recovery caldron in a sulfate paste plant was put in operation and found to work very satisfactorily, provided certain precautions described in the paper are taken. The gases withdrawn from the sampling devices are free from solid particles and moisture and are absorbed by a soda-glycerol solution for spectrophotometric determination of sulfur dioxide and hydrogen sulfide. The accuracy of this determination is 1%, provided the operator is well trained and the specified procedure is rigorously adhered to. If calibration curves have been determined with the aid of control solutions; if the reagents, are ready for use; and if the speed of the gas in the flue is known, one should have all results available within two hours. The colorimetric reagents used are quite specific at the concentrations of constituents studied.

Methylmercaptan does not perturb the spectrophotometric determination of H2S. The latter is determined directly by measuring the optical density at 680 nanometers, while the concentration of methylmercaptan is usually determined (after precipitation of H2S by CdCl2) by measuring the optical density at 515 nanometers. The accuracy of the described method of SO2 and H2S determination is 10%.

2884 APTIC NUMBER 20278

Christensen, Kenneth M.
CONTINUOUS SAMPLING GAS TESTING APPARATUS FOR USE IN DUSTY ATMOSPHERES. (Pillsbury Co., Minneapolis, Minn.) U. S. Pat. 3,495,458. 3p., Feb. 17, 1970. 3 refs. (Appl. Nov. 20, 1967, 4 claims).

An apparatus for sampling and testing a dust-containing atmosphere in a chamber is described. A blower draws the atmosphere out of the chamber through an inlet duct and returns it through an outlet duct. A psychrometer is mounted above the inlet duct. A pivoted disc filter is rotated past the inlet and outlet ducts. Dust which is filtered from the atmosphere as it enters the inlet is blown free of the filter as the atmosphere is returned to the chamber. (Author abstract modified)

2890 APTIC NUMBER 21237

Cieplinski, E. W., W. Averill, and L. S. Ettre
SIMPLIFIED ANALYSIS OF LIGHT GAS MIXTURES WITH GAS CHROMATOGRAPHY. J. Chromatog., 8(4):550-554, Aug. 1962. 6 refs.

A 4-valve system attached to a commercial gas chromatograph is described which allows the installation of 3 different coiled columns along with a reverse flow valve. The carrier and sample gas flow into the 3 columns in series, and into the reverse flow valve. By turning the individual valves, each column can be disconnected from the gas flow during analysis. With this system, the light gas analysis can be solved in two ways. The first possibility is to install 2 columns in the system and inject 2 consecutive samples into the instrument. The 2 columns are in series and therefor all components, except carbon dioxide (which will be absorbed on the molecular sieve column) will be detected. For the second analysis, the molecular sieve column is disconnected; thus, carbon dioxide can be separated from the other components which will give one peak on the second run. The advantages of the system are that the two columns can remain installed in the gas chromatograph; thus, no time is necessary for column change; it allows protection against water adsorption on the adsorption columns; and the valving system can be used for many other purposes where column combinations or backflushing are necessary.

2891 APTIC NUMBER 21368

Clair, Hillary W. St.
GAMMA AND BETA DISTRIBUTION FUNCTIONS APPLIED TO SIZE DISTRIBUTION OF MINERAL PRODUCTS. Bureau of Mines, Washington, D. C., Rept. of Investigations 7309, 33p., Nov. 1969. 9 refs.
CFSTI: PB-188592

Size distribution data for a variety of grinding mill products are analyzed mathematically by the method of moments, and a computer program, written in BASIC, is described for claculating moments, distribution parameters, and the weight fraction in any size range. The size distribution curves for single pass grinding machines, such as the jaw or roll crusher, have a reverse J-shape, which is characteristic of gamma and beta distribution when the parameter p or p1 is equal to or less than zero; the size distribution curves for continuous grinding mills, such as the ball mill and hammer mill, have a well-defined mode, which is characteristic of gamma and beta distribution curves when the p parameters are greater than zero. Curves for feldspar, flint, and glass are indistinguishable, as the breakage pattern for homogeneous brittle materials having no residual grain structure is seemingly independent of the mineral species. The skewed bell-shaped weight frequency curves characteristic of continuous grinding mills, such as the bass mill and hammer mill, arise from selective breakage of the larger particles, thereby obliterating the size distribution characteristic of the primary breakage pattern. Size distribution data can be represented over a very wide size range by gamma and beta distribution functions. (Author summary modified)

2892 APTIC NUMBER 20529

Collison, Harold A., F. Lee Rodkey, and John D. O'Neal
DETERMINATION OF CARBON MONOXIDE IN BLOOD BY GAS CHROMATOGRAPHY. Clin. Chem., 14(2):162-171, Feb. 1968. 13 refs.
CSFTI, DDC: AD 666011

The carbon monoxide content of normal human blood determined on 0.1-ml samples by the present procedure is in agreement with values obtained by other chromatographic or infrared methods; elimination of vacuum extraction or gasometric dilution of liberated CO makes the analysis less time-consuming and less technically demanding than other methods. Only minor modifications of available chromatographs are needed to insert the nickel catalyst between the separating column and the hydrogen-flame ionization detector; the reaction vessel, designed to replace the standard gas sample loop, is adaptable to many analyses which require measurement of gases released from aqueous solutions. Use of a column of Ascarite between two layers of Drierite to remove carbon dioxide and water during carrier gas sweep-out of the reaction tube prevents rapid deterioration of the 5 A molecular-sieve separating column. This column separates CO completely from other blood gases, and such constituents as CO2, oxygen, nitrogen, preformed methane, or other trace organic components of blood do not interfere with the analysis. When required, the separating column may be regenerated by being heated to 220 deg for 24-48 hours while a low flow of carrier gas is maintained. (Author conclusions modified)

2893 APTIC NUMBER 20496

Comer, Stanley W. and Andreas V. Jensen
SPECTROPHOTOMETRIC DETERMINATION OF TOTAL NITROGEN DIOXIDE AND NITROGEN TETROXIDE IN AIR. Anal. Chem., 36(4):799-800, April 1964. 8 refs.

A Beckman DK-2 spectrophotometer with a 10-cm Vicor cylindrical gas cell protected by a light-tight covering and provided with black Tygon tubing was used to determine total nitrogen dioxide and tetroxide. It was equipped with a time-drive mechanism to obtain % T vs. time at constant wave length, which was selected as 400 millimicron as most suitable to detect NO2 in air. The purpose of the analytical procedure was to determine the combined concentration of NO2 and N2O4 from the measured concentration of NO2, the only one 'seen' by the spectrophotometer. To find the concentration of N2O4 corresponding to the measured value for N2O, Verhoek and Daniels' equations for the dissociation constant of N2O4 were used. A graph of the degree of dissociation of N2O4 in air at 25 C and 0.9 atmospheric pressure at different volume % of (N2O4+NO2) in air is shown. To obtain a calibration curve for the spectrophotometric measurements of the NO2 concentration, liquid anhydrous nitrogen tetroxide was used. Thin-walled tear-drop-shaped ampuls of known weight drawn to a capillary opening were filled with various amounts of liquid N2O4 by gentle preheating, cooling with a pellet of dry ice while the capillary end was immersed in liquid N2O4 at 0 C, gentle reheating to expel the remaining air, and refilling by recooling. Sealed off by flame and weighed, they were dropped into a 56.5 liter bottle which was immediately stoppered. The ampul broke on impact and a homogeneous N2O4-NO2-air mixture of known composition formed which was pumped by a diaphragm pump through the gas cell of the spectrophotometer. Sufficient data were obtained in this manner to construct a graph of absorbance vs volume % of (N2O4+NO2), corrected for the calculated degree of dissociation of N2O4. The average error was 3.5%.

2894 APTIC NUMBER 21490

Corn, Morton
THE EFFECT OF DUST PARTICLE ORIENTATION ON PARTICLE SIZE DETERMINED BY MICROSCOPIC TECHNIQUES. Am. Ind. Hyg. Assoc. J., vol. 24-25:1-7, 1963-64. 15 refs. (Presented at the Annual Meeting of the American Industrial Hygiene Association, Cincinnati, Ohio, May 9, 1963.)

Narrow forward angle transmission of a monochromatic light beam through an aqueous suspension of dust particles during and after settling was used to obtain particle projected area. Measurements were alternately made in two mutually perpendicular directions, horizontal and vertical. Random orientation was characterized by equal particle projected areas in these two directions. Narrow size range samples of suspensions of quartz, bituminous coal, anthracite coal, and diamond were evaluated. The apparatus is briefly described and results are discussed in terms of commonly employed particle sizing procedures. (Author abstract)

2895 APTIC NUMBER 21639

Costache, Cornelia and Victor Muica
DETERMINATION OF MANGANESE IN THE AIR IN THE AREA OF ELECTRODE MANUFACTURE AND WELDING. (Determinarea manganului in aer la sudura si la fabricarea electrozilor). Text in Rumanian. Igiena (Bucharest), 11(4):349-353, 1962.

A rapid technique was devised for the determination of manganese in the air near welding units and in electrode manufacturing plants. The samples were taken with elongated tubes with grooved walls which were packed with glass wool moistened with HNO3. Following air aspiration, the tube was washed with hot HNO3, which was collected in a colorless glass beaker to which AgNO3 was added; after boiling, saturated K2S2O8 was added dropwise. After the formation of the red-violet color due to KMnO4, the solution was kept boiling for 2 min until no more color intensification was observed. For colorimetric determination, similar treatment was given to an aliquot of fresh HNO3; a standard solution of MnSO4 was added dropwise to the boiling liquid. Chromium, Fe, and Ce interfere with the analysis. Sensitivity of the method is 0.002 mg Mn/50 ml.

2896 APTIC NUMBER 20973

Coste, Andre
CONTRIBUTION TO THE STUDY AND DEVELOPMENT OF CONTINUOUS ANALYZERS BY INFRARED ABSORPTION. (Contribution a l'etude et a la mise au point des analyseurs en continu par absorption infrarouge). Text in French. Commissariat a l'Energie Atomique, Saclay, France, Centre d'Etudes Nucleaires, CEA-R-3527, 108p., Jan. 1969. 45 refs.

A new system was developed of continuous gas analysis by infrared absorption, which determines the concentration of a gas on the basis of a single line of its vibrational-rotational spectrum. It uses a single beam, and functions satisfactorily also when measuring the concentration of strongly corrosive gases. The relationship between the measured valve of the optical density, D, at the center of the spectral line, the width of that line, the spectral passband of the system function of the monochromator used, and the length of the test gas chamber were studied. In the near infrared, the use of Lorentz' absorption profile is entirely justified; the concentration, C, of a gas in a binary gas mixture is related to the optical density, D, and the total pressure, P, of this mixture by a quadratic law of the form: C equals (A.D square)/P square, where 0.05 smaller than C smaller than 2 mole %. A modification of this system includes a sub-assembly consisting of four interference filters which were periodically moved into the path of the bear traversing the test gas chamber, with which absorption measurements could be made on four nonoverlapping spectral lines of a gas. The absorption law was the same as that for a single line. At low concentrations and at total pressures of P greater than 100 torr. the relation between concentration and the optical density and total pressure is of the first degree: C equals (K.D)/P. In order to apply these methods to wave-lengths up to 15 micron, mirror optics and a thermocouple detector were employed in conjunction with transistorized electronic circuits.

2897 APTIC NUMBER 20742

Curry, Charles E.
GAS ANALYZER. (Assignee not given.) U. S. Pat. 3,476,516. 13p., Nov. 4, 1969. 2 refs. (Appl. Sept. 12, 1966, 22 claims).

A gas analyzer is described which is suitable for accurately measuring, with the application of appropriate safeguards, the amount of alcoholic content of human blood by analysis of the exhaled breath, and recording the result of the test. It comprises a gas input, measurement and control section, a liquid supply, control and waste section, a gas-liquid reaction vessel, optics to measure the light transmission of a standard sample and a reacted sample, readout structure, and an electric circuit to relate the various parts. Optical balance between the reacted sample and standard sample is accomplished by photo cells connected to a galvanometer and bucking each other. In order to prevent change due to aging and voltage fluctuation, a single lamp is used to supply illumination to two blue light transmission reading photo cells for the standard and test samples. This lamp is moved until the photo cell outputs are the same, and thus the lamp position is the readout signal. While the present gas analyzer uses a standard solution of potassium dichromate and sulfuric acid for alcohol reaction purposes, it employs a bulk source of this solution. Furthermore, a portion of this solution is pumped first to the standard cell and then through the test cell so that the use of the same solution in both test cells is assured. The entire gas analyzer is arranged so that if any errors occur in the actual readout value of a blood alcohol percentage, such error produces lower rather than higher readings.

2898 APTIC NUMBER 21279

Dams, R., J. A. Robbins, K. A. Rahn, and J. W. Winchester
NONDESTRUCTIVE NEUTRON ACTIVATION ANALYSIS OF AIR POLLUTION PARTICULATES. Anal. Chem., 42(8):861-867, July 1970. 10 refs.

A computer-assisted neutron activation analysis procedure is described which permits the nondestructive analysis of air pollution particulate matter for up to 33 elements in solid form. For measurements of short-lived isotopes, samples are first irradiated for 5 min at a flux of 2 times 10 to the 12th power neutrons/sq cm sec. The samples are then irradiated for 3 min after which a count of 400 sec live-time duration is begun; this is followed by a count of 1000 sec live-time starting 15 min after irradiation. For measurements of long-lived isotopes, samples are irradiated at a higher flux (1.5 times 10 to the 13th power neutrons/sq sec) for 2-5 hrs. Next, the samples are counted once for 2000 sec live-time after 20-30 hrs of cooling and then for 4000 sec live-time after 20-30 hrs of cooling. All spectra are recorded on magnetic tape and the data automatically reduced. The computer program qualitatively determines the presence of isotopes; calculates net peak areas; converts areas to weights of trace elements; and calculates concentrations of trace elements in the originally sampled air. Both the irradiation and counting procedure are graphically illustrated, and the gamma transitions used are listed. The reproducibility of the method is indicated by the results of replicate determinations of aerosols collected in the southern Lake Michigan basin.

2899 APTIC NUMBER 21384

Delly, John Gustav
FLUORESCENCE MICROSCOPY IN PARTICLE IDENTIFICATION. Particle Analyst, 1(2A):209-218, Dec. 20, 1968. 8 refs.

General environmental dusts, such as office dust, air conditioner dust, and industrial area street samples, all contain a host of particles that fluoresce with a variety of colors and with various intensities, leading to a particle's identification. Ultraviolet fluorescence is excited by radiation of 365 nm, while blue-violet fluorescence peaks at 400 nm. The most intense sources of 'black light' are high-tension sparks between magnesium electrodes, iron arcs, 100-W and 250-W mercury vapor arc lamps, water-cooled mercury lamps and the various quartz mercury lamps. Exciting filters which produce 365 nm radiation include the Kodak Wratten filter 18A (glass), the Corning Violet Ultra Glass 5860, and Corning's Red Purple Ultra Glass 5874 and 5970, while the barrier filter for UV can be the Kodak Wratten 2A, which does not fluoresce and absorbs all wavelengths less than 400 nm, or the 2B or 2E can be used. Blue-violet radiation can be produced with Corning glass filter 5850 or the Kodak Wratten 49 or 50, while barrier filters for blue-violet fluorescence are orange. Heat-absorbing filters are also frequently necessary. A fluorescence microscope is set up in essentially the same manner as a conventional microscope except that uranium glass is used to trace the UV rays and aid in alignment. A quartz slide should be used, and the most useful mounting medium is pure glycerin. The best color film for photomicrography is High Speed Ektachrome Film, Daylight Type (ASA 160), but even with high-speed 35-mm color film, exposures will be much longer than for normal photomicrography. Pollens all fluoresce blue-white in UV, catalysts do not generally fluoresce, nor do combustion products, except for wood from an incinerator.

2900 APTIC NUMBER 20926

Dept. of Transport, Toronto (Canada), Meteorological Branch
AUDIO MODULATED TETHERSONDE SYSTEM. Instrument Manual 93, 37p., 1969 (?).

The operation and use of the Audio-Modulated Tethersonde system is given. The airborne instrumentation is tethered to a helium-filled balloon and is used to make detailed measurements of temperature, pressure, and relative humidity in the lower 500 m of the atmosphere. The instrument is also capable of accepting additional sensors which are compatible with a resistive-type input. The Tethersonde employs the white rod thermistor and carbon hygristor of the standard radiosonde as temperature and humidity sensors; pressure is measured by an aneroid barometer, modified to yield a resistive output. Sequencing of the various sensors into the telemetry circuit is accomplished by a miniature gear-motor, operated as a stepped servo. The electronics are solid-state, consisting of a clock to actuate the servo system and an audio oscillator to convert the resistive output of the sensors into an

audio frequency in the 5 to 200 Hz range; an 89 MHz transmitter relays the information to the ground receiving station. Ground equipment is a simple omnidirectional receiving antenna, a modified fm receiver, a solid state frequency-to-dc converter, and a portable potentiometric recorder. Computational methods for extracting the recorded data are very similar to those used with the standard radiosonde. (Author introduction modified)

2901 APTIC NUMBER 21640

Dikun, P. P.
QUANTITATIVE DETERMINATION OF LOW CONCENTRATIONS OF 3,4-BENZPYRENE BY MEANS OF THE THIN STRUCTURE OF FLUORESCENT SPECTRA. Probl. Oncol (USSR) (English translation from Russian of: Vopr. Onkol.), 7(7):32-41, July 1961. 14 refs.

A new method for measuring small amounts of 3,4-benzpyrene in a substance entails adding pre-determined amounts of 1,12-benzperilene to the fraction under study and then comparing the relative intensity of two lines of the fluorescent spectra: the 3,4-benzpyrene line with lambda equals 4021 A and the 1, 12-benzperilene line with gamma equals 4060 A. The substances are dissolved in n-hexane and frozen in liquid nitrogen. The fluorescent lines are so arranged that the radiation of one of the compounds has a minimum effect on the corresponding line of the other, even though they are close together. Measurement of the correlation between the intensities of fluorescence of the two lines is effected by ordinary photography. The method is extremely sensitive. Using the fine structure, 0.05 to 0.1 gamma or less of 3,4-benzpyrene can be determined with great accuracy. The mean deviation in 15 control measurements was only plus or minus 8%. Deviations above 10% were noted in only 3 out of 15 measurements, and these did not exceed 13%.

2902 APTIC NUMBER 21600

Dubois, L., Ann Corkery, and J. L. Monkman
THE CHROMATOGRAPHY OF POLYCYCLIC HYDROCARBONS. Intern J. Air Pollution, 2(3):236-252, March 1960. 85 refs. (Presented at the Am. Chem. Soc., 136th Nat'l. Meet., Air Pollution Symp., Atlantic City, N. J., Sept. 1959.)

A scheme of analysis is presented for pure polycyclic hydrocarbons and extracts of these as found in airborne particulate matter. This is based on preliminary separation of solutions or extracts on columns of deactivated alumina, followed by paper chromatographic separations of individual fractions. For optimum separation the use of acetylated paper has been found essential. Paper chromatography is carried out by an ascending method. The run is stopped when the solvent front has traveled 35 cm, and the dried chromatograms are inspected under ultraviolet light. Zones may be outlined with pencil and Rf values determined; note is made of the characteristic color of the zones under ultraviolet light. Duplicate chromatograms may be sprayed with color developing reagents. From the Rf values and colors of the sprayed and unsprayed chromatograms preliminary identification can be made. Identification becomes more positive by using ultraviolet absorption spectroscopy and ultraviolet fluorescene spectroscopy. These techniques are performed on individual spots while still on the paper. Paper chromatography of the commercially available reagent grades of polycyclic hydrocarbons shows that very few are of adequate purity. Reproducibility of Rf values has not been satisfactory, which is believed to be due to variability in the acetyl content of paper, from sheet to sheet, and within the sheet. With almost no exceptions, however, the sequence of separation of a particular group of polycyclics is always the same for a particular set of operating conditions. (Author abstract modified)

2903 APTIC NUMBER 20666

Dubois, L. and J. L. Monkman
USE OF FRONTAL ANALYSIS IN SAMPLING AND DETERMINATION OF ATMOSPHERIC CARBON MONOXIDE. (L'emploi de l'analyse frontale pour l'echantillonnage et le dosage de l'oxyde de carbone dans l'air). Text in French. Mikrochim. Acta, 27(2):313-320, April 1970. 9 refs.

The sampling of carbon monoxide (at a concentration of 10 ppm in the experiments) was accomplished by adsorption over a 5 A molecular sieve by frontal analysis, followed by elution with hydrogen. The carbon monoxide was then reduced to methane, which could be measured with a flame ionization detector. This approach to sampling eliminates all of the problems encountered in conventional sampling over adsorbents. Thus it is not necessary to know the volume of the sample or to eliminate the water present in the atmosphere, and one can use any type of adsorbent employed in gas chromatography, which means that an adsorbent can be chosen that is specific for each of the compounds to be determined.

2904 APTIC NUMBER 20488

Dugway Proving Ground, Utah, Instrumentation Div.
REMOTE CONTROLLED SEQUENTIAL SAMPLER DEVELOPED BY DUGWAY PROVING GROUND. TR-DPG DD 67-20, 17p., May 1969.
CFSTI, DDC: AD 695628

A Wired Grid Sequential Sampler collects 9 sequential samples of vapor agent from the atmosphere with provision for additional sequential sample collection by serial sampler connection. The amount of air drawn through the sampling device is controlled by use of critical flow orifices and can be determined with an accuracy dependent upon the tolerance allowed in the manufacture of the orifices. Its control unit can be used with various sampling devices which utilize the vaccum principle of operation. Requirements are 115 volts AC power and a vacuum source capable of maintaining 13-1/2 inches of mercury vacuum while sampling at any desired rate up to 12-1/2 liters per minute. Remote control of the time of operation for each sample is provided, allowing the characteristics, with regard to concentration, persistence, and dispersion vs. time, of various aerosols released into the atmosphere to be determined. (Author abstract)

2905 APTIC NUMBER 20892

Durst, R. A.
ANALYSIS OF MISCELLANEOUS MATERIALS. 1. DETERMINATION OF FLUORIDE IN DUST SAMPLES. National Bureau of Standards, Washington, D. C., Microchemical Analysis Section, TN-505 p. 83-84, Oct. 1969.

The versatility of the fluoride ion-selective electrode was demonstrated by its application to the determination of fluoride in a sample dust. The analysis of fluoride in the sample was performed using combustion in an oxygen flask. Three determinations were made on 0.2 to 0.3 g samples. The mean sensitivity of the method was 88 ppm. The oxygen flask employed was a polycarbonate flask. Diethylene glycol was added to the sample to aid combustion. The absorbant was a potassium nitrate solution. A fluoride ion-selective electrode and a plastic silver-silver chloride reference electrode were used for the direct potentiometric determination of the fluoride. The electrode system was calibrated with standard fluoride solutions from 0.001 to 0.00001 M.

2906 APTIC NUMBER 20895

Durst, R. A
CONSTRUCTION AND CHARACTERISTICS OF A FLUORIDE ION-SELECTIVE MICROELECTRODE. National Bureau of Standards, Washington, D. C., Microchemical Analysis Section, TN-505, p. 79-82, Oct. 1969.

The feasibility of constructing a fluoride microelectrode suitable for studies of microliter volumes of sample solutions was demonstrated. Although still about two orders of magnitude larger than the smallest glass electrode, further miniaturization of the electrode is possible along lines that could lead to intracellular fluoride determinations. The microelectrode is constructed from a polyethylene tubing drawn out to a 2-mm neck at the lower end. In its final form, the microelectrode tip is an exposed conical portion of lanthanum fluoride crystals of approximately 1.5 microliter volume. The crystal is insulated with polystyrene coil dope. The electrode employs a silver-silver chloride internal reference electrode and a NaF-KCl (each 0.1M) reference solution. The response of the electrode to fluoride activity deviated from Nernstian response in the micromolar range, but was 59.5 mV/pF in the more concentrated solutions. All measurements were made on macro volumes of stirred solutions (approximately 25 ml) against a normal-size saturated calomel electrode. By using the microfluoride electrode in conjunction with a microcapillary reference electrode, measurements could be made on 2-microliter volumes.

2907 APTIC NUMBER 20298

Pneaark, Robert B. and Donald F. Steele
SMOKE DETECTOR INCLUDING POROUS HOUSING MEANS. (Electro Signal Lab, Inc, Weimouth, Mass.) U. S. Pat. 3,497,303. 3p., Feb. 24, 1970. 4 refs. (Appl. July 11, 1967, 7 claims).

An arrangement of a local light source and photodetector is provided which minimizes unwanted reflections from the dark space to the photodetector; the volume of air passages to the dark space is increased while minimizing admission of external light, thereby increasing the ratio of smoke-scattered light to unwanted light. Smoke and other airborne particles are also prevented from increasing the reflectivity of the internal surfaces around the dark space. The smoke detector is comprised of opaque material with a surface facing into a dark chamber and surrounded by a semicircular housing formed of a porous material. The porous material is preferably comprised of a skeletal three-dimensional network of light-blocking material which in the aggregate thickness of the sheet material is effective to exclude outside light from the chamber, but provides interconnected pores transmissive of airborne smoke particles through the sheet material.

2908 APTIC NUMBER 21638

Feldstein, Milton
ANALYTICAL METHODS FOR AIR POLLUTANTS. In: Progress in Chemical Toxicology. A. Stolman (ed.), vol. 1, New York, Academic Press, 1963, p. 317-338. 22 refs.

Methods are presented for the analysis of atmospheric contaminants. Three categories of pollutants are considered. The first group are pollutants which may have a direct toxic effect if present in the atmosphere in sufficient concentration for a sufficient period of time. These include fluoride, carbon monoxide, sulfur dioxide, beryllium, and lead. The toxic effects which may be manifested include direct toxicity on man, toxic effects on vegetation, or indirect toxic effects on cattle foraging on vegetation which has absorbed or been dusted with the contaminant. The second group are pollutants which may not be present in the atmosphere in sufficient concentration to cause toxicity, but which create nuisance problems due to odor. These include hydrogen sulfide and mercaptans. The third group are pollutants which are involved in the photochemical process which occurs in the ambient atmosphere and which leads to the formation of reaction products which are eye-irritating, vegetation-damaging, and visibility-reducing. These pollutants include NO2, NO, and hydrocarbons. Of interest in this area is the measurement of O3 which occurs as a by-product of this photochemical process. The development of continuous automatic recording instruments for the measurement of certain air contaminants is discussed.

2909 APTIC NUMBER 21566

Fink, Uwe, D. H. Rank, and T. A. Wiggins
ABUNDANCE OF METHANE IN THE EARTH'S ATMOSPHERE. J. Opt. Soc. Am., 54(4):472-474, April 1964. 10 refs.

The abundance of methane in the earth's atmosphere was determined by assuming an effective temperature for the atmosphere of 250 deg K. When sufficiently high resolving power is used, the directly observed integrated intensity of methane lines becomes constant with air as the broadening agent. The abundance of methane was measured on a spectrograph, using absorption techniques on lines of very low J value. Experimental and mathematical techniques are

described. Results of this experiment agree with previous ones using less realistic effective temperatures.

2910 APTIC NUMBER 20259

Fontijn, Arthur, Alberto J. Sabadell, and Richard J. Ronco
HOMOGENEOUS CHEMILUMINESCENT MEASUREMENT OF NITRIC OXIDE WITH OZONE. IMPLICATIONS FOR CONTINUOUS SELECTIVE MONITORING OF GASEOUS AIR POLLUTANTS. Anal. Chem., 42(6):575-579, May 1970. 16 refs. (Presented at the 158th National American Chemical Society Meeting, New York, Sept. 1969.)

The reactions of common air pollutants, such as nitric oxide, nitrogen dioxide, and carbon monoxide, with certain second reactants such as ozone or O atoms, are known to result in light emissions. Measurements of the emission intensity could be used to determine the concentration of the pollutants. In a detectorr based on this principle, ambient air and the second reactant would be continuously flowed through and mixed in a reactor under moderate vacuum. After calibration, a continuous record of pollutant concentration could be obtained. Specific sensitivity to a given pollutant would be obtained by a suitable choice of second reactant and a light filter. To demonstrate the feasibility of the method, the detection of NO using O3 was studied experimentally. A linear response from about 4 pph(v/v) NO to at least 100 ppm NO was obtained. Nitrogen dioxide, carbon dioxide, carbon monoxide, ethane, ammonia, sulfur dioxide, and water in concentrations encountered in air quality control did not interfere with NO monitoring. Based on these results and experimental data for other chemiluminescent reactions, it is concluded that homogeneous chemiluminescence monitors can be probably developed for at least O3, NOx(equals NO plus NO2), and CO. (Author abstract modified)

2911 APTIC NUMBER 20438

Foumenteze, J. L.
DIFFICULTIES OF GAS SAMPLING FOR ITS CONTINUOUS ANALYSIS. (Les difficultes de la prise de gaz en vue de son analyse continue). Text in French. Rev. Met. (Paris), 64(1):61-71, Jan. 1967. 6 refs. (Presented at the Journee des Mesures en Siderurgie, l'Association Technique de la Siderurgie, March 3, 1966, Paris.)

The present needs of the steel industry for continuous analyses of the composition of gas originating in blast-, coke-, or iron-ore agglomerating furnaces, gas generators, and the like are considered. Three types of continuous analysis are presented: one involves merely a continuous sampling of these gases and their chemical analysis by traditional methods or those made by an Orsat apparatus; one involves continuous sampling and the use of automatic recording analyzers providing current information regarding the process to a human operator in control of the process; one involves continuous sampling, automatic analysis, and automatic control without the intervention of a human operator. In every individual case, the design of the sampling equipment and procedure depends on the nature of the gases to be analyzed and on the peculiarities and scope of their analysis. Three sources of error are described: faulty sampling locations; malfunctioning of the sampling equipment due to coarse or fine dust, water or water vapor, high temperature of the sampled gases; and improper handling of the gas samples. The need for utilization of pertinent theoretical knowledge is stressed and, as well as the need for full and honest collaboration between user and maker of continuous sampling equipment in all stages of its design and installation.

2912 APTIC NUMBER 20538

Franzky, Ulrich
EMISSION MEASUREMENTS ON DRYING OVENS AND JELLYING CHANNELS WITH SECONDARY WASTE-GAS PURIFYING PLANTS FOR ODOR ABATEMENT. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(1):33-41, Jan. 1969. 9 refs.

Waste gases from ovens used for drying or baking colors have an intense odor due to the solvents and softeners emitted. For this reason, the government of North Rhine-Westphalia is limiting the carbon content of the combustible organic substances in undiluted, purified waste gas from drying ovens to 300 mg/cu m STP. A new technique will permit sampling for carbon concentrations between 100 and 300 mg/cu m STP. A heated probe aspirates a sample from the waste gas through a quartz tube filled with silica gel. The combustible organic substances are absorbed in the process. During subsequent treatment in the laboratory, the samples are desorbed in a flow of hot oxygen and combusted to carbon dioxide, the quantity of which is analytically determined. Emission measurements obtained by the method are reported for three polyvinyl chloride jellying channels and four continuous or quasi-continuous lacquer drying ovens. A plant that combined waste gas purification by catalytic combustion with waste-gas feedback achieved satisfactory reductions in the total amount of combustible substances present in the flue gas.

2913 APTIC NUMBER 21208

Fujii, Soichi
MEASUREMENT OF INTERIOR ENVIRONMENT AND ITS EVALUATION. (Shitsunaikankyo no sokutei to hyokaho soron). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 7(6):1-4, March 1, 1970.

Though evaluations of interior environments have been extended to cover comfort and sanitation, the attainment of satisfactory living and working conditions will also require measurements of factors imperceptible to sensory organs. The eight kinds of measurements suggested in this paper comprise the following: (1) interior temperatures, which determine well-being to a great extent; (2) relative humidity; (3) radiant heat from both ceilings and walls; (4) air stream agreeable in summer but hot in winter; (5) cleanliness of indoor air where major contaminants are dusts, toxic gases, noxious odors, and bacteria and, in some cases, the amount of atmospheric ions; (6) ventilation; which may not actually be necessary if the air is clean; (7) illumination, involving intensity of light, light distribution, glare or intrusion of direct rays of the sun, and color of light; and (8) noise, which is difficult to measure. It is recommended that suitable criteria be provided for four categories of indoor

environments: ideal, good, average, and the worst allowable limit.

2914 APTIC NUMBER 20623

Fujitaka, Shuhei, Tatsuo Kawamura, Sakuro Tsurumi, Hiroshi Kondo, Taisuke Seta, and Mitsuyoshi Yamamoto
JAPANESE METHOD OF ARTIFICAL POLLUTION TESTS ON INSULATORS.
IEEE (Inst. Elec. Electron. Engrs.) Trans. Power App. Systems, 87(3):729-735, March 1968. 4 refs. (Presented at the Institute of Electrical and Electronics Engineers Summer Power Meeting, Portland, Ore., July 9-14, 1967,) Paper 31 TP 67-491.

Salt pollution on insulators has been one of the serious problems in designing power system insulation in Japan, and research has been carried out on methods of artificial pollution tests in order to evaluate the flashover characteristics of polluted insulators. The deposit on the insulators is dissolved in a certain amount of distilled water and the conductivity of the solution is measured; then the amount of the electrolyte is expressed in terms of the equivalent sodium chloride, giving the same conductivity of the solution. In carrying out the artificial pollution test, a salt solution of various concentrations containing a certain amount of kaolin is prepared and sprayed on the insulator giving a required density of salt deposit and sufficient moisture, and after the stabilized condition is obtained on the polluted insulator surface, flashover voltages are measured by raising the applied voltage. (Author introduction modified)

2915 APTIC NUMBER 21604

Geisel, W.
TEST ON THE ROTARY FLOW DUST COLLECTOR, ITS APPLICABILITY AS MEASURING DEVICE FOR PARTICLE SIZE ANALYSIS. (Untersuchungen an Drehstroemungsentstauber, seine Einsatzmoeglichkeit als Messgeraet fuer Korngraessenanalyses). Text in German. Aufbereitungs-Technik, 9(1):9-13, 1968. 6 refs.

A laboratory model of the rotary flow dust collector (DDS 40) was tested for its separating properties to determine if it is possible to employ it for particle size analysis. The fractional dust collecting efficiency curves of this device were determined. Particle size analysis of clean air and bin dust samples were conducted using Andreasen sedimentation analysis and an improved Bacho air separating method. Comparatively flat efficiency curves resulted; a determination of particle size, as it is effected by the Bacho air separator, was only conditionally possible. Therefore, a relation of the limit particle size to the overall dust collection efficiency was also set up. Thus, by a dry process, dusts can be air separated in the DSS 40 up to the fineness reached with the aid of Andreasen analysis.

2916 APTIC NUMBER 21274

Gilluly, Richard H.
TRACE ELEMENTS IN AIR AND WATER. Sci. News, 97(22):538-539, May 30, 1970.

A method for the analysis of trace elements in the atmosphere has been developed. It involves irradiating the sample with neutrons and measuring the intensity of the gamma-rays emitted from the isotopes thus formed. One advantage is that the samples can be irradiated before any chemical reagents are added, thus eliminating the possibility of introducing impurities. Eight elements were identified from 0.01 micrograms to several micrograms/cu m after short irradiations: sodium, aluminum, chlorine, calcium, vanadium, manganese, copper, and bromine. Elements found in smaller quantities after longer irradiations were: scandium, iron, cobalt, nickel, zinc, antimony, selenium, barium, and several others. The varying amounts and proportions of the elements in different geographic regions provide a key to the sources. Boston's high banadium level is believed to be due to the burning of a heavy fuel oil containing vanadium; bromine levels seem to correlate with the lead levels in gasoline additives; and aluminum and selenium are probably products of coal burning.

2917 APTIC NUMBER 21333

Glauberman, Harold
THE DIRECTIONAL DEPENDENCE OF AIR SAMPLERS. Am. Ind. Hyg. Assoc. J., vol. 19:235-239, May-June 1962. 6 refs.

Two filtration-type air samplers were tested in turbulent or positive directional air streams to determine if sampling is dependent on orientation of the sampling instrument. Uranium oxide dusts of 0.76, 2, and 3.25 micron median diameters were collected on Whatman #41 filter discs. In turbulent air, no bias was found due to orientation. In a directional air stream, a sampler head facing into the air stream collected more dust by a factor of two. (Author abstract)

2918 APTIC NUMBER 20712

Go, F. and A. Ohshino
STUDIES ON THE MEASUREMENT OF ATMOSPHERIC SULFUR DIOXIDE POLLUTION BY LEAD PEROXIDE. PART II. (Nisankanamari ni yoru taikichuaryusanqasu sokuteiho no kento (2)). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):21, 1969. 2 refs. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Pursuant to an earlier experiment indicating that the rate of collection of sulfur dioxide increases in proportion to the square root of wind velocity, a further experiment was conducted on the effect of temperature and humidity on the collection rate by means of a constant concentration exposure device. Temperature and humidity were negligible in practice. For a lead dioxide candle, the rate of capture depends on the diffusion rate of sulfur dioxide molecules and the concentration gradient at the stagnant layer near the surface. A first-order differential equation as formulated by Johnstone and Roberts in order to describe the capture rate on a cylindrical surface in fluid flow was introduced; by various approximations and with the assumption that temperature and humidity effects are negligible, the

earlier formulation on the accumulation rate of sulfur trioxide corresponded closely to the theoretical formulation by Johnstone and others.

2919 APTIC NUMBER 21271

Goetz, Alexander
DEVICE AND PROCESS FOR COLLECTING PARTICULATES FROM GASES. (California Inst. Research Foundation, Pasadena) U. S. Pat. 3,475,951. 8p., Nov. 4, 1969. 5 refs. (Appl. May 18, 1965, 14 claims).

A device for collecting submircon size particles is described. The device consists of an impaction nozzle and a polished opaque collecting plate. The nozzle directs parallel gas flow paths toward and away from the plate, with a 180 degree turn about a knife edge at the plate. A nozzle inlet passage with a continuously decreasing cross section provides a continuous and uniform gas acceleration, a double slit nozzle, and a collecting plate drive which moves the plate in steps of varying velocity with each step of a constant velocity. The particulate concentration is determined by light scattering measurements. (Author abstract modified)

2920 APTIC NUMBER 21399

Grimes, Annie E.
AN ANNOTATED BIBLIOGRAPHY ON METHODS OF VISIBILITY MEASUREMENT, 1950-1969. FSSA ATSTM LIB 2, 64p., Sept. 1969. 179 refs.
CFSTI: PB-188652

A total of 179 references on methods of visibility measurement, from the U. S. and foreign literature are given, each with an abstract. The references are arranged by year of publication. An author index and an index to instruments and techniques is provided. Instrumentation covered includes balloons, photometric devices, lidar, nephelometers, radiometers, smokemeters, spectrography, and transmissometers.

2921 APTIC NUMBER 20558

Grinnell, S. W., F. K. Webster, and T. S. Brown
STUDIES ON THE PERFORMANCE OF THE ROTOROD FP SAMPLER. Metronics Associates, Inc., Palo Alto, Calif., Aerosol Lab., Contract DA-42-007-AMC-21(R), MP-21(R)-3, 74p., June 23, 1965.
CFSTI, DDC: AD 692320

The Rotorod FP (fluorescent particulate) sampler consists of a small, governed, 12-volt DC motor which rotates the H-shaped collector rod at 2400 RPM. An impact sample of the particulate matter suspended in the ambient air is deposited on the leading edges of the collector rod. It has a high volume sampling rate and low power requirement, but the impaction process is not 100% sufficient in the FP size ranges now employed. The results from six field experiments show that when apparent dosages from Rotorod sampling are corrected for the average efficiency obtained from a given lot of FP, the dosages obtained are consistent with those obtained from closely adjacent membrane filters exposed to the same FP cloud. The results furthermore indicate a distinct tendency for the dip-coated rods to show about 2.5% less collection efficiency than for manually coated rods. In 154 comparisons, standard deviations ranged from 6% to 10%. No significant difference in efficiency was found between Rotorods oriented in the standard vertical position and those oriented horizontally. The correlation between the collection efficiency and particle size parameters was investigated by assuming that the FP materials follow the Rosin-Rammler particle size distribution. The collection efficiencies were plotted against the NMD (number mean diameter) estimates of particulate material. The correlation shows an almost linear increase with NMD up to about 2 micron. Agreement between the estimated NMD's and those calculated from the complete size distribution was very good.

2922 APTIC NUMBER 17577

Griswold, S. Smith, Arthur A. Atkisson, Robert E. Neligan, Frank Bonamassa, and Wallace Linville
RESEARCH AND TEST FACILITIES OF THE LOS ANGELES COUNTY AIR POLLUTION CONTROL DISTRICT. Preprint, Air Pollution Control Association, New York City, 17p., 1962. 7 refs. (Presented at the Air Pollution Control Association Annual Meeting, 55th, Chicago, Ill., May 20-24, 1962, Paper 62-67.)

The research and testing facilities of the Los Angeles County Air Pollution Control district include the following: a dynamometer laboratory, in which samples of engine exhaust may be produced under widely variable but controlled conditions, and exposed to qualitative and quantitative analysis; an environmental laboratory, in which diluted mixtures of contaminants may be exposed to controlled irradiation and interaction in close simulation of actual atmospheric conditions, and in which the resultant effects may be monitored by a variety of objective techniques; and analytical facilities capable of providing quantitative and qualitative analysis of ambient air and source samples through such techniques as gas chromatography, mass spectrometry, infrared spectroscopy, flame ionization analysis, and wet chemical analysis. The facilities occupy approximately 12,000 sq ft of usable floor area. The dynamometer laboratory includes one programming engine dynamometer, one chassis dynamometer, and three engine dynamometers. The environmental laboratory has two irradiation chambers, each with an internal volume of 1000 cubic feet or 30,000 liters. The chambers serve the study of photochemical smog and other air pollution problems. All test facilities mentioned are described in detail and illustrated.

2923 APTIC NUMBER 20896

Groot, R. C. De
IMPACTION PATTERNS OF SMALL FUNGUS SPORES COLLECTED ON EDGES OF MICROSCOPE SLIDES EXPOSED IN INTERMITTENT ROTOSLIDE SAMPLERS. Mycologia, vol. 59:739-743, July-Aug. 1967. 15 refs.

The suitability of the intermittent rotoslide sampler as a sampling device for small fungus spores and pollen was investigated in a study of the impaction pattern of spores on microscope-slide edges. Basidiospores of Ganoderma applanatum (4-6 times 6-9 micron), Pomes fomentarius (4-5 times 12-18 micron), and hyaline sperodical spores (3-5 and 5-8 micron) were collected in sufficient quantities to permit statistical analysis of their impaction patterns. Counts were made on the internal and external sides and in the middle of the edges at positions 0.5 cm apart, beginning 1.5 cm from the bottom of a slide. Distribution of Ganoderma spores was representative of the impaction pattern of the others. The spores were not collected uniformly or in consistent patterns over the surface of slide edges. Small spores tended to aggregate near the bottom and outer edges, suggesting the existence of a vortex within the sampler. The uneven distribution of the spores will necessitate a counting procedure which will represent all areas of the slide edges.

2924 APTIC NUMBER 20461

Gydell, Karl
SIMPLIFIED METHOD FOR DETERMINING CARBON MONOXIDE HEMOGLOBIN SATURATION IN DIAGNOSIS OF HEMOLYTIC DISORDERS. Acta Med. Scand. Suppl., 179(445):280-287, 1966. 13 refs.

A simple and accurate variant of the colorimetric method for determing low carbon monoxide concentrations in the blood is described. Alveolar air samples from the subjects were obtained by breathing pure oxygen is a rebreathing aggregate. The CO concentrations in the rebreathing gas samples were measured in special indicator tubes. These test tubes cover a range from 5 to 200 ppm. The gas sample is sucked through the tube with a pump, and a color change is obtained in the indicator substance which contains a mixture of iodine pentoxide and sulfuric acid. The gas volume needed for one analysis is one liter. The final level of the colored zone is read against the scale of the tubes. The carboxyhemoglobin concentration in the blood is calculated with Haldane's equation. A comparison with another method for CO determination indicates that this method is accurate enough for detecting significant hyperhemolysis in routine clinical work.

2925 APTIC NUMBER 20316

Hable, William L. and Elwin S. Bitney
GAS SAMPLE COLLECTION APPARATUS. (Universal Oil Products Co., Des Plaines, Ill.) U. S. Pat. 3,501,961. 5p., March 24, 1970. 6 refs. (Appl. Nov. 4, 1968, 5 claims).

A gas sample collection apparatus comprises two sample collection loops connected to the first of two body members of a gas sample valve body. The two body members are in slideable contact and positionable in two relative positions. The first body member has passageways, and the second has channels which interconnect the passageways in different sequences for each of the two relative positions. Alternately, one sample collection loop is filled with sample gas while the previously collected gas is carried from the other loop to an analyzing instrument. This device is particularly suitable for use with hydrogen flame ionization detectors, as well as other types of chromatographic gas analyzers. (Author abstract modified)

2926 APTIC NUMBER 20643

Hamaguchi, A. and K. Ito
IMPROVED MEASUREMENT FOR ATMOSPHERIC SULFUR DIOXIDE BY LEAD PEROXIDE. (Nisanka-namari ni yoru taikichu iwosankabutsu no kairyo sokuteiho). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):20, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Among the various factors that influence the ordinary lead dioxide method of measuring sulfur oxide concentration in air, such as the shape of the shelter, wind velocity, temperature, and humidity, wind velocity is believed to be the most significant, rendering the comparison of data from various locations difficult. A new method independent of wind velocity and giving data in terms of ppm is introduced whereby granular form of lead dioxide created by the addition of traganth solution is dried and packed into a hard vinyl chloride 'test tube.' After a long period (preferably a month) of air intake at a constant rate, the lead sulfide formed in the process is quantitatively analyzed. Together with the calculated total volume of air intake, the result of the analysis would yield the sulfur dioxide concentration. The method was fairly satisfactory in comparison to the traditional method.

2927 APTIC NUMBER 21021

Hasegawa, T. and T. Yamada
TOTAL SULFUR DETERMINATION IN FUEL. (Nenryochu no iwobun no bunsekihoho ni tsuite: dai-ippo). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):27, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The bomb method as well as the burner method specified in the Japan Industrial Standard (JIS) were compared to two other methods considered to be more expedient and with less subjective error in measuring the sulfur content of heavy oil: the absorption of X-ray from promethium 147, and the electrostatic titration of sulfur oxides produced by an induction furnace. The X-ray method was considerably more accurate than the bomb method for heavy oil, with a variance ratio significance level of five percent, and not as accurate for some types of crude oil. There were no differences from the JIS methods in terms of the expectations for all types of oil. The electrostatic titration method did not differ from the bomb method, both in the significance level of the variance ratio as well as the expectation. It was concluded that the effects of metals in the samples need to be taken into account.

2928 APTIC NUMBER 21372

Herpertz, Elmar
A SIMPLE LONG-TERM MEASURING PROCEDURE FOR DETERMINING THE DUST CONCENTRATION IN THE NEAR-GROUND AIR LAYER (LIB-METHOD). Staub (English translation from German of: Staub, Reinhaltung Luft), 29(10):12-18, Oct. 1969. 12 refs.

A device for routine measurements of suspended dust in near-ground air layers is described. The main components of the device are a rotary vane pump, a MF 250 constant-weight membrane filter mounted on a brass ring with a phosphor sieve, an aluminum filter holder, and an aluminum inlet tube. Air is aspirated by the pump through the filter, where the suspended matter is precipitated. The pressure drop across the filter is measured. The air sample heated to about 60 C in the pump is cooled in a cooling path to about 24 C and is passed through a gas meter. After the measuring period (which can be adjusted by a time switch) has expired, the pump is automatically switched off and the filter removed. The mean dust concentration (in micrograms/cu m) is obtained from the weight difference of the filter before and after sampling and the volume of sampled air measured by the gas meter. The detection limit of the procedure is 12 micrograms/cu m; the uncertainty range, plus or minus 6.0 micrograms/cu m for low dust concentrations and plus or minus 35 micrograms/cu m for high concentrations. The millipore filters may be replaced by glass fiber filters with no loss in measuring efficiency.

2929 APTIC NUMBER 20897

Hersch, P. and R. Deuringer
TRACE ADDITION OF NITRIC OXIDE AND NITROGEN DIOXIDE TO AIR BY ELECTROLYSIS. J. Air Pollution Control Assoc., 13(11):538-541, Nov. 1963. 4 refs.

Trace levels of toxic air pollutants pre-established by mixing are affected by adsorption and reaction in containers, ducts, and fittings, making an exact synthesis of polluted air difficult. Nitric oxide and nitrogen dioxide can be evolved at controlled rates by an electrolytic method that eliminates the uncertainties of infusing, injecting, or admixing these gases ready made from a stored supply. When nitrosyl-hydrogen-sulfate or dinitrosyl-disulfate salts are dissolved in concentrated sulfuric acid and electrolyzed between platinum wire electrodes under an atmosphere of nitrogen, nitric oxide is quantitatively evolved from the cathode according to the reaction NO(+) + e(-) equals NO. Nitrogen dioxide is evolved by mixing the nitric oxide evolved at the cathode of one electrolyzer with the oxygen evolved at the anode of a second electrolyzer. If the gases are mixed before reaching the diluent gas stream, the undiluted NO oxidizes instantly, and only NO2, together with excess O2, enters the gas stream. Care must be taken to avoid absorption of the NO2 formed by the sulfuric acid. The NO2 is introduced into and retained in a column of ascarite. Although developed primarily for the calibration and study of NO(-) and NO2(-) analyzers, these electrolytic methods may be of interest also in model experiments on air pollution reactions and in chemical kinetics general'y.

2930 APTIC NUMBER 21615

Hickling, Robert
SCATTERING OF LIGHT BY SPHERICAL LIQUID DROPLETS USING COMPUTER-SYNTHESIZED HOLOGRAMS. J. Opt. Soc. Am., 58(4): 455-460, April 1968. 7 refs.

A cathode-ray tube linked to a computer is used to synthesize holograms of spherical liquid droplets illuminated by plane waves of monochromatic linearly polarized light. The classical Mie solution is employed to determine the far-field radiation pattern of the light waves scattered by the droplets. The most distinctive maxima and minima in the radiation pattern of a droplet occur in the side scattering adjacent to the forward lobe, when the droplet is viewed in a plane that is perpendicular to the direction of polarization of the incident waves. Typical examples of these maxima and minima were recorded on the computed holograms. The reference source was an electric dipole with its axis of polarization parallel to the direction of polarization of the light waves incident on the droplet. A holographic method is suggested for determining the size of spherical droplets in a range of diameters. (Author abstract modified)

2931 APTIC NUMBER 20596

Hidalgo, John U.
STUDY OF THE APPLICATION OF LASER TECHNOLOGY TO ATMOSPHERIC CONTAMINATION MEASURATION. (FINAL REPORT). Tulane Univ., New Orleans, La., Radiation Lab., NASA Contract NAS 12-668, 81p., April 30, 1969. 19 refs.
CFSTI: N69-36282

A program is being developed to investigate the application of laser technology to the measurement of impurities and pollutants in the atmosphere, with emphasis on techniques which are applicable to atmospheric probing from remote stations. The study plan calls for a series of 'folded-path' measurements to relate the attenuation of a folded beam to parallel measurements of pollutants and meteorological parameters. The suitability of the technique to measurements of ozone and ethylene is discussed, and two idealized system models are considered: a two-dimensional two-path system, and a pure diffusion model. Equipment required includes two individually tuneable CO2 gas lasers, a sensitive infrared receiver, electronics for signal processing, and remote beam reflector stations; the specifications and performance of these are described in detail. Two folded optical paths were established, 1400 ft and 3300 ft long, and laser transmissions were tested over these paths. Because of equipment and other difficulties, the complete two-laser system was not completed, but the experience gained with a single laser is fully reported and is expected to be of great value in future refinement of the technique.

2932 APTIC NUMBER 20915

Hilbig, Gerhard
PARTICLE SIZE DISTRIBUTION OF POLYDISPERSE SYSTEMS BY MEANS OF THE

FIRST MAXIMUM METHOD. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(5):1-5, May 1969. 13 refs.

Particle size distribution of monodisperse systems is easily determined by measuring the spectral attenuation coefficient of a stable suspension prepared from the system to be studied. When the refractive indexes of the system and the liquid used to prepare the concentration are known, the value of the maximum attenuation coefficient and the corresponding light wavelength are used to calculate particle radius and the number of particles per unit volume. Because the physical significance of the particle radius and its interconnection with the parameters of particle size distribution were not understood, the method has not been valid for polydisperse systems. These problems are theoretically evaluated; the method is applicable to polydisperse systems when the concentration is known and the particle size distribution is Maxwellian in character.

2933 APTIC NUMBER 21045

Hirasawa, S.
I. MEASUREMENT OF SULFUR OXIDES IN FLUE GAS. I-4 ARSENAZO III METHOD. (1. Haigasu chuno isoankabatsu sokuteiho. I-4 Arusenazo III ho). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 22(2):17-19, Feb. 28, 1970.

Under a 1953 standard, torine(?) was to be employed as an indicator in measurements of sulfur oxides in flue gas and titration carried out with N/100 barium chloride solution. In this method, the color changes from yellow to pink at the end of titration, but the change is not distinct enough for the end point to be determined without great skill. For this reason, the standard has been revised to substitute Arcenazo III for torine. At the end of this method, the color changes from red to blue. The change is comparatively obvious and its evaluation is not affected by the barium sulfate which is precipitated at the end of titration. In contrast of 50-700 ppm for torine, the range of measurements by the Arcenazo III method is 50-2000 ppm. A 3% hydrogen peroxide solution is used as the absorbent for the sampled gas. After absorption, isopropyl alcohol, glacial acetic acid, and Arcenazo III are added to the solution. When barium acetate is employed as the titrating solution, all sulfur oxides can be quantitatively measured.

2934 APTIC NUMBER 20703

Honma, K. and M. Suzuki
RESPONSE OF ROYCO AEROSOL MONITOR TO NONIDEAL PARTICLES. (ROYCO Aerosol Monitor no kakushuryushi ni yoru sokuteichi no hendo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):37, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Devices which facilitate the measurement of particle concentration of aerosols by particle size have been developed based on the application that the intensity of light scattered by aerosols is the function of particle size. A ROYCO Aerosol Monitor was tested to observe how it would perform in the measurement of particle sizes in various artificially produced aerosols such as DOW polystyrene latex, PVC, flyash, carbon black, and activated charcoal compared to the measurements by an electron microscope. The process of aerosol production is diagrammed, and the graphical analysis of the results show that the greatest discrepancies between the two methods appear in activated charcoal and carbon black. Electron microscope-to-ROYCO ratio of values for the charcoal was 0.65, probably due to the non-uniform sphericity of the particles; the ratio for carbon black was 1.17, leading to the suspicion that for this particle size, dark current affects the ROYCO measurements.

2935 APTIC NUMBER 20989

Huang, Chao-Ming, M. Kerker, E. Matijevic, and D. D. Cooke
AEROSOL STUDIED BY LIGHT SCATTERING. VII. PREPARATION AND PARTICLE SIZE DISTRIBUTION OF LINOLENIC ACID AEROSOLS. J. Colloid Interface Sci., 33(2):244-250, June 1970. 17 refs.

Linolenic acid aerosols of narrow size distribution were generated by condensation of vapor upon sodium chloride and silver chloride nuclei in a helium gas stream. The particle size distribution was determined by analysis of the angular distribution of the polarization ratio of the scattered light, as determined by a photometer. In addition, the particle concentration was obtained from the absolute value of the Rayleigh ratio. These aerosol particles can be solidified for electron microscopic observation with osimum oxide which permits a comparison of the light-scattering results with electron microscopy. Also, the determination of particle concentration from measurement of the Rayleigh ratio was compared with direct collection by thermal precipitation and filtration and subsequent acidimetric titration. The consistency obtained for a particular aerosol at two different wavelengths was excellent. While the comparison of the light-scattering results with those obtained by electron microscopy indicated the latter were about 10% lower, the widths of the distributions were in good agreement, and even the absolute displacement was not considered excessive for such measurements. The internal consistency of the light-scattering results at two wavelengths and the fact that it is an 'absolute' method justifies its use as a primary technique, with electron microscopy an auxiliary and corroborative procedure. The results of a comparison of the number concentration obtained by the Rayleigh ratio method and that obtained by direct collection and acidometric microtitration, while insufficient to constitute a comparative study, indicated that N as determined by light-scattering was not too greatly at variance with those obtained directly. The performance of the aerosol generator was studied with respect to operating conditions. The modal particle size was observed to vary directly, though erratically, with boiler temperature and inversely with nuclear concentration and flow rate. The number concentration varied directly with nuclei concentration, inversely with flow rate, and was essentially unchanged by boiler temperature. (Author abstract modified)

2936 APTIC NUMBER 20717

Huebner, Victor R.
METHOD FOR THE CONCENTRATION OF TRACE IMPURITIES IN GASEOUS MEDIA

BY ABSORPTION. (Beckman Instrument, Inc., Fullerton, Calif.) U. S. Pat. 3,486,298. 6p., Dec. 30, 1969. 6 refs. (Appl. June 30, 1967, 6 claims).

Present analytical equipment, such as mass spectrometers or gas chromatographs, require a definite quantity of a compound before it can be detected. A number of applications, especially in the field of toxicity, require the detection, identification, and quantitation of compounds present at lower than normally detectable limits. When compounds must be analyzed at these very low concentration levels, a sample concentration step must be employed. A method of concentrating impurities to improve analytical sensitivity is described using porous polymer beads to absorb trace contaminants. Concentration, as used in gas chromatography, entails trapping the less volatile trace contaminations and discarding the more volatile bulk gases prior to analysis. If a retarding medium is used in a sample loop, quantitative collection of the trace contaminants can be achieved at much higher temperature eliminating the requirement for drastic cooling. Poropak beads not only have the greatest known capacity and degree of retardation of the available absorbent materials, but are completely non-reactive and extremely stable.

APTIC NUMBER 20619

2937

Ingram, William T.
PERSONAL AIR-POLLUTION MONITORING DEVICES. J. Ind. Hyg., 25(3):298-303, May-June 1964. 4 refs.

The development of monitoring devices that can be operated while attached to an ambulatory individual is discussed, and existing equipment is reviewed; a preliminary report is presented of tests performed with one instrument equipped with impregnated silica-gel tubes and controlled air flow for collecting and measuring nitrogen dioxide, sulfur dioxide, total hydrocarbons, and carbon monoxide, together with a filter disc to capture particulates. The first phase of development of a second device using silica-gel pack from which the gases could be desorbed and analyzed by gas chromatography is also examined. It appears from these tests runs of the first instrument that air flow will have to be increased through all tubes to get readability at levels normally found in New York City atmosphere, and there is some question of reliability on ambient air gas measurement at minimal concentrations. Grain size of gel is not uniform; hand filling and tapping, together with variable inside diameter of tubes, also leads to non-uniformity of results. Techniques for obtaining impregnated papers that can be quantitated by color shade or some other suitable and easily conducted methodology are in the process of being investigated. (Author abstract modified)

APTIC NUMBER 21143

2938

Toos, Ernst and Manfred Emmerichs
A NEW SAMPLING PROBE FOR DUSTS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(10):26-27, Oct. 1969. 3 refs.

A two-part sampling probe suitable for coarse-grained dust and not subject to clogging was modified to enable sampling of fine dusts. The new sampler consists of an outer tube and an inner half-tube, the latter rendered adjustable in a form-locking manner. Both parts are provided with handles, the handle of the inner half-tube serving simultaneously as a guide pin. When sampling, the inner tube is first pierced into the material and is then followed by the outer tube. The sample withdrawn is representative of the depth of penetration. For coarse dust, which easily falls out of the sampler due to the low adhesion of inner walls, piercing should be carried out in the horizontal direction.

APTIC NUMBER 20540

2939

Ivie, James O., D. Thomas, Moyer, and Leonard P. Zielenski
AUTOMATIC SENSING AND RECORDING OF AIR POLLUTANTS ON CITRUS TREES. Biomed. Sci. Instrum., vol. 1:45-52, 1964. 6 refs. (Presented at the First National Biomedical Sciences Instrumentation Symposium, Los Angeles, Calif., June 16-17, 1963.)

Various instrument techniques used for measuring and for controlling air pollutants with respect to experiments with citrus trees in Southern California are described. The automatic punch card recording system is used to record date, time of day, plant transpiration, apparent photosynthesis by carbon dioxide exchange, nitrogen dioxide, nitric oxide, ozone, total oxidants, hydrogen fluoride, temperature, and integrated light recording. The punch card recording permits automatic handling of data on the IBM 1620. The master timer and valve control unit controls operation of the CO2 and moisture analyzers. It collects 30 min inlet and outlet air samples from 12 plots. These samples are stored in plastic bags and in the succeeding 30 min are fed into the CO2 infrared analyzer and a humidity analyzer. Oxides of nitrogen are recorded continuously by a colorimetric method based on a diazotization reaction with the Griess-Saltzman reagent. Ozone as well as other oxidants are also measured colorimetrically by the potassium iodide reaction. Hydrogen fluoride is determined by observing the quenching of the fluorescence on magnesium oxinate impregnanted filter paper tape. An Eppley pyrheliometer is used to measure the light received on a horizontal surface. Twelve temperatures are recorded by the logger directly by thermocouples connected to the input of the scanner.

APTIC NUMBER 21397

2940

Jacobson, M. and J. A. Lamonica
PERSONAL RESPIRABLE DUST SAMPLER. Bureau of Mines, Washington, D. C., Mineral Industry Health Program, TPR-17, 8p., Sept. 1969. 1 ref.
CFSTI: PB 187773

Equipment for sampling and evaluating respirable dust concentrations in the breathing zone of individual miners is described, and directions are given for its use. The first stage of the two-stage sampler is a 10-millimeter nylon cyclone which performs as an elutriator or size-selector. The second stage is a membrane filter that collects the respirable fraction

of the dust; the collected dust is weighed to the nearest 0.1 milligram, and concentrations are expressed as milligrams of dust per cubic meter of air sampled. The device continuously samples air from the worker's breathing zone during the full working shift by drawing the atmosphere through the device at 2.0 liters per minute with a portable, battery-operated diaphragm pump. The equipment is now commercially available.

2941 APTIC NUMBER 21179

Jonassen, Niels and Marvin H. Wilkening
AIRBORNE MEASUREMENTS OF RADON 222 DAUGHTER IONS IN THE ATMOSPHERE. J. Geophys. Res., 75(9):1745-1752, March 20, 1970. 4 refs.

An ion collector suitable for use aboard an aircraft was developed for the determination of the concentration of radon 222 daughter ions in the lower atmosphere. The collector uses a transverse electric field in a concentric-cylinder geometry to deposit positively charged daughter ions onto an aluminum foil. At the conclusion of a collection, the alpha activity is measured with an alpha-scintillation detector. The collector is operated so that all ions having mobilities greater than 0.00004 sq m/v sec are deposited. Collections of radon daughter ions were made on four different flights during July, 1968 and on five flights during February 1967 with an earlier version of the collector. The flights of July 18 and 27, 1968, were made in the early morning so that no appreciable convective effects of surface heating had occurred. Data for July 16, 1968, were taken at midafternoon when thorough mixing of the atmosphere had taken place. The operation of the device aboard an aircraft while air samples for radon 222 were collected simultaneously made possible the determination of the fraction of the total equilibrium value of radon daughter products that existed as small ions in a given environment. Typically, this ratio is of the order of 10% with larger values occuring in the early morning hours before eddy diffusion produces a well-mixed lower atmosphere. Vertical profiles show a decrease in both radon 222 and the daughter product small ions with increasing altitude in a stable atmosphere; these same quantities remain roughly constant with height in a well-mixed atmosphere. (Author abstract modified)

2942 APTIC NUMBER 21161

Juda, Jan
EVALUATION OF ATMOSPHERIC POLLUTION BY MEANS OF RANDOM MEASUREMENTS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(10):1-6, Oct. 1969. 1 ref.

A random measurement method of evaluating concentrations of pollutants is described. The measuring points form a regular grid of squares with a side length of 2 km. At individual points, the air pollutants are determined in accordance with a series of random measurements lasting 20 min. At each point 15 measurements are carried out over a period of a year, their dates and times determined by random numbers. From the results obtained at 4 measuring points representing the vertices of a square of the grid, a series of 60 final results is formed. This series can be represented graphically as the cumulative frequency for one year. The trend of the points can be approximated by a straight line in coordinates of probability versus log of concentration. As required by Polish standards, the results are tabulated as frequencies of values smaller than the maximum permissible 24-hr mean value and the maximum permissible 20-min mean value of the concentration. Continuous determinations were carried out simultaneously with random measurements in areas of high and low SO2 levels to check the method. In the case of continuous measurements, all 24-hr mean values were recorded, and in the case of random measurements, all 20-min values were recorded. The difference between the mean values was no more than 10%. There was also good agreement between logarithmic standard deviations.

2943 APTIC NUMBER 20725

Jugle, Lawrence C.
AIR POLLUTION MEASURING SYSTEM. (Union Carbide Corp., Niagara Falls, N. Y.) U. S. Pat. 3,479,869. 6p., Nov. 25, 1969. 2 refs. (Appl. April 3, 1967, 1 claim).

A method for measuring the air pollution generated by a single pollution source is described, comprising a wind sensitive control device which electrically activates one or more pollution measuring instruments when the atmospheric wind is in a suitable direction. Wind acting upon a control device rotates a sensor so that the tip is pointing in the direction of the air flow. Simultaneous with the movement of the sensor, an indicator moves along the dial periphery until the sensor is aligned with the wind direction, at which time the indicator mates with one of the contact points. An electrical signal is then brought from a power supply through the indicator to the contact point. If the particular contact point which is mated with the indicator is in a position on the dial representative of a wind direction which is suitable, the electrical signal is carried through relays to activate the measuring instruments to an 'ON' state.

2944 APTIC NUMBER 21441

Juquet, B.
SURVEILLANCE OF THE RADIOACTIVITY OF AIR AND WATER. (La surveillance de la radioactivite de l'air et de l'eau). Text in French. Tech. Sci. Munic., 64(3):123-130, April 1969. 3 refs. (Presented at the Annual Meeting of the A.G.H.T.M., Nov. 5, 1968.)

Methods of measuring natural and artificial radioactivity of the atmosphere and of surface water are presented. Sources of natural radioactivity in the Paris area include cosmic radiation, radon emitted by radium contained in rocks and other natural materials, and the natural potassium in which the isotope 40 is always present in a constant ratio and which accounts for a radioactivity of the order of 0.7 disintegrations per minute per milligram. Sources of artificial radioactivity stem from a variety of scientific, industrial and medical applications of isotopes and from nuclear explosions in air. Beta-radiation (formed by fast-moving electrons) has a relatively long life and

is readily measured by a Geiger counter with a source of electric power and an electronic counter. Alpha-radiation emitted by elements heavier than lead (atomic number 82) is very weak but can be measured with the aid of a photomultiplier which determines the intensity of scintillation of Zn sulfide activated with Ag exposed to alpha-particles. The same method is used to measure the radiation emitted by radon and by radium. Gamma-radiation is of the same nature as visible light, and may be measured indirectly with the aid of a 'gamma-ray spectrometer'. The unit of radioactivity is a 'curie' (Ci) corresponding to 3.7 times 10 to the 10th power disintegrations per second. Air radioactibity is of the order of a picocurie (p Ci) equal to 10 to the -12th power. Ci. Radioactive fallout is measured in millicuries/sq km. Various radioactivity data are given and a method of 'dating' nuclear measurements of radioactivity of samples containing fission products or different rather short lifetimes is decribed.

2945 APTIC NUMBER 21509

Kassner, J. L., Jr., J. C. Carstens, and L. B. Allen
THE MYTH CONCERNING THE CONDENSATION NUCLEUS COUNTERS. J. Rech. Atmos., 3(1-2):25-31, 1968. 9 refs. (Presented at the international meeting of comparison des Generateurs et Compteurs de noy aux de Condensation et de noyaux Glacogenes, Lannemezan, France, Sept. 8-23, 1967.)

Errors in calibration techniques traced to the Aitken pocket-counter and stemming from wall heating and particle diffusion to the walls are pointed out; the need for recalibration against a more sophisticated expansion cloud chamber is stressed. Difficulties in determining droplet growth rate and errors associated with the use of fine wire thermocouples are reviewed. Development of the Aitken nucleus spectrum and corrections for droplet growth by means of a series of expansions to progressively higher supersaturations, and the use of a sample dilution technique to minimize the effect of vapor depletion are suggested to render Pollack counter readings more meaningful.

2946 APTIC NUMBER 20678

Kelleher, Raymond L.
METHOD AND APPARATUS FOR ATMOSPHERIC SAMPLING. (Gonzaga Univ., Spokane, Wash.) U. S. Pat. 3,474,659. 7p., Oct. 28, 1969. 6 refs. (Appl. Dec. 13, 1967, 15 claims).

Gas detection methods and devices are used for quantitative and qualitative analysis of outdoor atmospheric samples taken from a moving vehicle. The method includes the reception of an atmospheric sample volume at an uncontrolled pressure and subsequent equalization of the pressure of the sample volume with the static pressure of the atmospheric source prior to analysis. A pitot-static tube is utilized in a dynamic relationship relative to the source, and a selector valve is included that places the sample volume in alternate communication with the pitot connection and the static connection of the pitot-static tube. A differential pressure indicating gauge is utilized to indicate pressure equalization at the static connection. The analytical tools comprise of infrared spectrophotometry and adsorption chromatography. (Author abstract modified)

2947 APTIC NUMBER 21181

Kent, G. S. and R. W. H. Wright
A REVIEW OF LASER RADAR MEASUREMENTS OF ATMOSPHERIC PROPERTIES. J. Atmospheric Terrest. Phys., 32(5):917-943, May 1970. 66 refs.

The results of laser-radar measurements made on the atmosphere at altitudes between 10 and 100 km are reviewed. Laser-radar theory and practice are discussed in relation to the scattering properties of the atmosphere. Variations in atmospheric temperature and density which are believed to occur are outlined and the limitations in present knowledge discussed. A brief account is also given of the results of observations on atmospheric aerosols by methods other than laser-radar, i.e, aircraft and balloon borne sample collection, balloon borne measurements by photoelectric counter, searchlight, and twilight sky brightness. The results from laser-radar studies are examined and critically discussed in relation to atmospheric models. Comparison of results requires assumptions regarding size distributions which can introduce major uncertainties; nevertheless, the general distribution of aerosol concentrations is beginning to emerge. Below 30 km, there is a growing body of data which contain some conflicting results. Above 30 km, the information is quite inadequate. Laser radar in its simplest form cannot provide information about atmospheric density and temperature below 30 km. However, highly developed and powerful systems at present in operation are not able to record statistically significant signals at all heights below 90 km. This data can be used to provide estimates of the day-to-day and diurnal changes that occur from the standard atmosphere. The oscillations of density caused by 'tides' or 'internal gravity waves' can also be detected and studied. The emphasis in this review is placed upon the evaluation of laser-radar for providing information about aerosol content, atmospheric density and its variations, and atmospheric composition. (Author abstract modified)

2948 APTIC NUMBER 21305

Miller, F. C. A. and K. E. Underhill
MICROCOULOMETRIC DETERMINATION OF TRACE SULPHUR IN LIGHT PETROLEUM PRODUCTS. Analyst, vol. 95:505-513, May 1970. 13 refs.

The coulometric determination of trace amounts of sulfur in volatile liquid petroleum products is investigated by using a Dohrmann microcoulometer incorporating a combustion furnace, initially designed for the determination of sulfur in gas-chromatographic effluents. The original quartz combustion tube was replaced by a larger diameter tube to increase the residence time of gases in the combustion zone. The inlet was modified to allow direct injection of samples into the combustion tube and the inlet temperature was increased to 400 to 500 deg C. The technique was applied to petroleum products ranging from naphthas to gas oils to determine the total sulfur content in the

concentration range 2 to 1000 ppm. Precision and accuracy data are supplied, and factors affecting peak shape as well as interferences caused by halogen and nitrogen compounds are discussed. (Author abstract)

2949 APTIC NUMBER 20300

Kishimoto, Y., K. Fujisawa, and E. Yamashita
THE IMPROVED TEST OF LOW VOLUME AIR SAMPLER. (Low volume air sampler no kairyo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution) 4(1):31, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The traditional low volume air sampler was modified by considering the following: emphasizing in connection with the shelter for the filter paper holder; the capture of fine-grain suspended particles highly adhesive to the alveoli of the lung; maintaining the accuracy and the intake volume of the cumulative flowmeter for the purpose of long-term continuous capture; and examining the oilless pump in terms of durability and suction. The resulting modification produced improvements such as the removal of more than twice as many particles in the 10 micron range in the atmosphere, and the virtual elimination of the reduction in flow rate occurring in the traditional sampler after a month's use.

2950 APTIC NUMBER 20509

Knott, Marta J. and Walter L. Crider
ANALYSIS OF OZONE FROM OXIDANTS CONTAINED IN AUTOMOBILE-EXHAUST ANIMAL-EXPOSURE CHAMBERS. Preprint, National Air Pollution Control Administration, Cincinnati, Ohio, Div. of Health Effects Research, 12p., 1969 (?). 13 refs.

Bufalini's trans-2-butene gas-phase titration method was used in conjunction with a Mast ozone meter to selectively determine ozone concentrations from a variety of oxidants contained in smog-like animal exposure chamber atmospheres of photochemically-reacted automobile exhaust. Data obtained from this method for specific ozone analysis were then used to develop a mathematical expression for computing past ozone concentrations from monitoring data on total oxidant and nitrogen dioxide concentrations previously collected during the exposure study. Ozone concentrations computed with this equation were in good agreement with the experimental ozone values found from the trans-2-butene reaction. The method was 104% accurate with 17% precision, and the procedure was judged to be more accurate and precise than other methods of atmospheric analysis now available.

2951 APTIC NUMBER 20324

Koblin, Abraham, Alfred L. Woolridge, and Robert W. Dorsey
AIR SAMPLER DEVICES. (United States Army) U. S. Pat. 3,495,440. 4p., Feb. 17, 1970. 5 refs. (Appl. April 23, 1968, 9 claims).

An improved bubbler type absorber is described for determining low concentration aerosol particles and vapor in the atmosphere. It comprises an air inlet, an absorption chamber, a means to create turbulent flow within the absorption chamber, and an air exhaust apparatus. The turbulent flow is induced by the centrifugal force created by the fluid flow through a coil, and it results in an extremely large surface area being presented for collection of aerosol particles within the coil and for highly efficient vapor absorption by the absorption liquid.

2952 APTIC NUMBER 20731

Koblin, Abraham, Alfred L. Woolridge, and John Q. Adams
CONTINUOUS AND AUTOMATIC FALLOUT SAMPLER. (United States of America) U. S. Pat. 3,475,965. 5p., Nov. 4, 1969. (Appl. March 1, 1968, 18 claims).

A method and apparatus are described for evaluating particle fallout from toxic atmospheric spray contaminants. Unlike previous methods, measurements of particle size droplets are not adversely affected by undue amounts of precipitation and do not require tedious counting systems. Waterproof collecting tape is contained in a stainless steel housing, provided with means to avoid precipitation build-up. Droplet fallout generated by a toxic spray is deposited on the surface of the collecting tape and photographed. The photograph is then compared to a family of photographs made from calibration runs which utilized known particle size distribution. Such comparison is possible because, in the absence of moisture, the toxic spray droplets stain the water-proofed tape. The size of the stain is a measure of particle size. Since the photographic equipment is started simultaneously with the start-up of the collecting tape, the time shown on a 24-hr increment clock, and the frame number photographed on the edge of the film, the given droplet size distribution at a given time is known by comparison with the calibration charts. Any increase or decrease in concentration over a period of time can also be ascertained. Provisions can be made for the remote control of the monitoring system.

2953 APTIC NUMBER 21552

Kolerskii, S. V. and L. S. Ruzer
DETERMINING THE COMPOSITION OF AEROSOLS BY MEANS OF TWO MEAN RADII. Meas. Tech. (USSR) (English translation from Russian of: Izmeritel. Tekhn.), no. 10:1356-1360, Oct. 1968. 5 refs.

If the errors in measuring the mean values of the tested quantity are known, the problems of determining the parameters of distribution can be completely solved when measuring the dispersed composition of aerosols by the method of two mean values. For the case of distribution and relationship, when the exponents remain constant within the tested range of particle size, expressions are presented for determining log Beta q and log gamma q and their errors with respect to combinations of selected measuring methods and errors in determining the mean values of the measured quantities. A combination of diffusion and nephelometric measurements provides the minimum error in determining log Beta q

and log gamma g. In addition, the method appears promising for measuring the most monodispersed aerosols. (Author conclusions modified)

2954 APTIC NUMBER 20922

Kon'kov, S. A.
RECORDING ATMOSPHERIC DUST CONCENTRATION. (O registratsii kontsentratsii pyli v atmosfere). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no.234:181-187, 1968. 3 refs.

A method for recording the weight concentration of dust with constant gravimetric calibration and continuous recording of the optical density of weighed portions of dust on a filter is reported. A prototype instrument was built and tested and is distinguished from similar devices in that the MEL-4 cloth-ribbon filter has improved filtering characteristics. A number of other filtering materials were also tested. Filter characteristics are as follows: resistance at a specific air flow rate of 0.06 l/min.sq cm at 1.8-3.0 mm H2O; passage coefficient, 10%; weight, 6 mg/sq cm; thread diameter, 1.5 mu; and operating temperature, 50 C. A sample plot of dust concentration, made in the environs of Leningrad is shown.

2955 APTIC NUMBER 20682

Koshi, S., K. Homma, and H. Sakabe
ON THE CHARACTERISTICS OF VARIOUS FILTERS FOR THE SAMPLING OF AEROSOL. (Aerosol sampling-yo filter no tokusei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution) 4(1):16, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Filter materials for aerosol measurement that are relatively easy to obtain in Japan were tested for thickness, weight, compactness, hygroscopicity, pressure loss, particle collection rate, and the content of mineral impurities; the results are tabulated for the selected materials. For a cellulose type and a glass fiber type filter, the variations in the collection rate with filtration velocity at various particle sizes were plotted, and the randomness of collection rates was plotted for all materials. The filter materials possessed qualities competitive with those internationally recognized; cellulose and cellulose-asbestos removed moisture up to 10%, and the randomness of the collection rates was large. Some membrane filters could capture particles one-tenth their pore size; and materials usually included iron, copper, zinc and lead.

2956 APTIC NUMBER 21550

Krasnogorskaya, N. V., Yu. Ya. Kurilenko, and I. M. Nybin
INVESTIGATION OF PRECIPITATION PARAMETERS OF PARTICLES IN THE FREE ATMOSPHERE. (Issledovanie parametrov chastits osadkov v svobodnoi atmosfere). Text in Russian. Fiz. Atm. i Okeana (Moscow), 3(12):1292-1304, 1967. 12 refs.

An instrument is described for airborne measurement of particles 0.3-4 mm in diameter with particle charges ranging from 0.0001-0.1 esu. Error analysis is presented with special attention given to the problem of droplet breakup at the edge of the instrument intake; a pulse-length limiting system is used to suppress unwanted signals from these droplet fragments. The possible mechanism of charge formation on raindrops is reviewed. Data from flights made in 1962-1965 in the vicinity of Dnepropetrovsk are presented. Measurements were made at heights of 100-2000 meters in both rain and snow. Particle size and charge were generally lower in steady than in torrential rain. There was little evidence of charge transfer upon passage of the droplets through ionized air.

2957 APTIC NUMBER 20988

Kvifte, G. I. and L. Wallace
A METHOD OF DETERMINING THE ATMOSPHERIC SODIUM CONCENTRATION FROM TWILIGHT OBSERVATIONS. Planetary Space Sci., vol. 18:623-635, April 1970. 9 refs.

Simple formulae are given for computing the simultaneous amount of sodium in the twilight and the daytime sky from one set of observations of the D1 and D2 line intensities in twilight. The formulae are derived from an approximate solution of the transfer equation for a plane parallel atmosphere and conservative isotropic scattering. The accuracy of the formulae are compared with results obtained by calculating the sodium twilight emission rate using Chandrasekhar's X and Y functions for the same problem and taking into account the overlapping of the hyperfine lines composing the two sodium lines. For reasonable optical depths of the sodium, the simple formulae agree with the more sophisticated calculations within about 5% i.e., well within the accuracy of the present technique of measuring airglow line intensities. The formulae are, therefore, suited to an easy and sufficiently accurate reduction of twilight sodium data. (Author abstract)

2958 APTIC NUMBER 17856

Lahmann, Erdwin and Karl-Ernst Prescher
METHODS FOR AUTOMATIC AIR MONITORING. (Methoden zur automatischen Luftuntersuchung). Text in German. Gesundh. Ingr., 91(1):21-24, Jan. 10, 1970. 24 refs.

Sampling and measuring methods for air pollutants used in Germany are described. Gaseous pollutants are mostly adsorbed in liquids. Adsorption on silica gel or direct measurment with an infrared analyzer is less frequently used. Dusts are mostly sampled by filters. Sampling can be done automatically in almost all cases. Sulfur dioxide content is measured by electroconductivity analyzers. Carbon monoxide is measured in the gaseous phase by absorption of infrared rays at wave lengths between 2 and 15 micron. Hydrocarbons are continuously and automatically measured by a flame ionization detector. For the continuous measurement of ozone, an instrument was developed in Germany which determines electrochemically the bromine liberated by the ozone passed through a potassium bromide solution. Photometers permit

simultaneous continuous measurement of several pollutants. Graphical plotters are mostly used for recording the measured data. As an example, the automatic air monitoring system operating in Berlin since August 1968 is described. At six stations, SO2 concentrations are measured. The data are transmitted to a central station where they are recorded.

2959 APTIC NUMBER 21344

Lampe, Kenneth F. and William P. Deichmann
THE IDENTIFICATION OF NITRO-OLEFINS IN THE COMBUSTION PRODUCTS OF HYDROCARBONS. Ind. Med. Surg., 33(5):281-283, May 1964. 9 refs.

Isobutylene was burned in an internal combustion engine to determine whether nitro-olefins were produced during hydrocarbon combustion. As determined by gas chromatographic analysis of the exhaust, both a conjugated nitro-olefin and its nonconjugated tautomer were formed during combustion. It is suggested that automotive exhausts may be a contributing factor in human pulmonary carcinoma. (Author abstract modified)

2960 APTIC NUMBER 21415

Larrat, P. and J. Louise
CONTINUOUS DETERMINATION OF TRACE AMOUNTS OF SO2 IN THE ATMOSPHERE AND IN OTHER GAS MIXTURES. (Dosage continu de traces de SO2 dans l'atmosphere et autres melanges gazeux). Text in French. Chim. Anal. (Paris), 52(4):397-399, April 1970. 3 refs.

A method is proposed for making a wide range of sulfur dioxide content determinations: from concentrations on the order of 10 to the minus 6th power to those on the order of 10 to the minus 2 power. It offers the advantage that it does not require reference gas mixtures but only titred sulfuric acid solutions. The sulfur dioxide is first oxidized with hydrogen peroxide, after which the resulting sulfuric acid is determined by the conductimetric method. The method was tested with a gas rate of flow of 20 l/hr using 100 cu cm/hr of the liquid reagent. Absorption of SO2 was complete, and the relative accuracy of measurement was plus or minus 3 %.

2961 APTIC NUMBER 20959

Leroux, Jean and C. A. Powers
DIRECT X-RAY DIFFRACTION QUANTITATIVE ANALYSIS OF QUARTZ IN INDUSTRIAL DUST FILMS DEPOSITED ON SILVER MEMBRANE FILTERS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(5):26-31, May 1969. 9 refs.

The present trend in assessing dust exposure is toward evaluating only the respirable fraction. It is further accepted that a knowledge of the quartz percentage in a sample of dust in the respirable size range would constitute one of the best parameters in assessing the health hazard in a dust-laden atmosphere. An X-ray diffraction technique is described that permits the direct analysis of quartz in respirable samples covering a circular area of 8 sq cm and weighing between 0.2 and 1.0 mg. The samples are analyzed by reference to standard quartz samples obtained by a method discussed in an earlier paper. The problem of the diffraction patterns of hydrocarbon and cellulose compounds used in industrial filters interfering with quartz diffraction lines is overcome by using silver membrane filters. Use of these filters and molybdenum radiation enables accurate measurements of samples containing 10 microgram of quartz/sq cm.

2962 APTIC NUMBER 21041

Leroux, Jean and Mazhar Mahmud
FLEXIBILITY OF X-RAY EMISSION SPECTROGRAPHY AS ADAPTED TO MICROANALYSIS OF AIR POLLUTANTS. J. Air Pollution Control Assoc., 20(6):402-404, June 1970. 6 refs.

Methods for analyzing thin dust coatings of airborne particulates were evaluated for their applicability to vast air pollution surveys. Choice of glass fiber filters adapted to high volume samplers restricts the analysis to a limited number of elements, such as lead. More flexibility and versatility are attained through the use of organic membrane filters mounted in small plastic monitors which permit multi-elemental analysis at least as accurately as with other popular but time consuming techniques. Due to the small area of coating irradiated by x-ray(usually 1.5 sq cm), the size of the filter in the monitor can be as small as 7 sq cm. Under these conditions, shorter intervals of sampling are obtained as compared to the 25 hr sampling time required with conventional hi-volume sampler using 8 by 10 in. glass fibers. Since the method is non-destructive, the sample is analyzed directly as received, thereby decreasing the number of possible experimental errors. Its accuracy in the range of sensitivity required for an average air pollution sample is at least as good as that of atomic absorption. The major delay with x-ray analysis is the sampling time itself, since approximately 5 minutes is required for the analysis of a single element after receipt of sample, as compared to several hours for other conventional techniques. These qualities of speed and accuracy allow shorter intervals of sampling with are normally required for better statistical assessment of broad air pollution surveys. The sensitivity of the technique reaches a value close to 0.05 micrograms/cu m. (Author abstract modified)

2963 APTIC NUMBER 20547

Linderholm, H., T. Sjostrand, and B. Soderstrom
A METHOD FOR DETERMINATION OF LOW CARBON MONOXIDE CONCENTRATION IN BLOOD. Acta Physiol. Scand. (Stockholm), vol. 66:1-8, 1966. 19 refs.

A method is described for measuring the carbon monoxide content of blood, particularly at low concentrations. The error of a single determination was 1-3% of the total amount of CO (range 0.7 - 70 microliters) present in the analyzed sample. Different procedures for the release of CO from the blood were compared. The reagents used were sulfuric acid, KH(JO3)2 (Merck. Pro analysi), and K3 Fe(CN)6. Equal and slightly smaller amounts

of CO were obtained with K3 Fe(CN)6 and H2SO4 than with KH(JO3)2, if blood with a low CO content was analyzed. Evidently KH(JO3)2 causes extra CO formation from the blood. If extraction of CO from the blood took place at a high oxygen partial pressure, slightly higher amounts of CO were obtained than with extraction in vacuum or in an atmosphere of nitrogen. The results indicate that small amounts of CO may be formed during procedures used for release of CO from blood, probably due to oxidative breakdown of hemoglobin. (Author abstract modified)

2964 APTIC NUMBER 21491

Lippmann, Morton
A COMPACT CASCADE IMPACTOR FOR FIELD SURVEY SAMPLING. Am. Ind. Hyg. Assoc. J., 22(5):348-353, Oct. 1961. 3 refs.

A new design for a cascade impactor is presented. Particulate matter is collected at four impaction stages on two standard 1 in. by 3 in. glass microscope slides, with two deposits on each slide. The deposits can be spread out during collection by using an external slide movement mechanism. A one inch diameter filter follows the impaction stages. A calibration nomograph is presented. Results obtained using this calibration are in good agreement with the results obtained by direct sizing of simultaneously drawn membrane filter samples. (Author abstract)

2965 APTIC NUMBER 20689

Lippmann, Morton
'RESPIRABLE' DUST SAMPLING. Am. Ind. Hyg. Assoc. J., 31(2):138-159, March-April 1970. 91 refs.

The potential health hazards arising from the inhalation of toxic aerosols can be related to the concentration of 'respirable' particles. The term 'respirable' refers to particles small enough to penetrate the tracheo-bronchial region of the lung. There are several factors which limit the precision of 'respirable' dust samples as hazard indicators. One is the questionable accuracy of the standardized deposition curves. Recent human deposition studies utilizing spherical test aerosols indicate large individual differences in regional deposition among non-smoking males, and indications of increased tracheo-bronchial deposition among smokers. Thus, the 'respirable' fraction of a given aerosol will differ with the individual. There are also instrumental uncertainties arising from several sources. One is the basic design and calibration of the size-selective samplers. Mult-stage sampler data can provide estimates of the 'respirable' fraction and deposition, and an overall size-mass distribution curve. One of the major factors limiting the application of selective sampling concepts has been the absence of recognized criteria for 'respirable' mass concentrations. Despite all of the uncertainties and instrumental problems, inhalation hazard evaluations based on 'respirable' mass are superior to estimates based on gross air concentrations for insoluble dusts whose site of toxic action is the deep lung. (Author conclusions modified)

2966 APTIC NUMBER 21086

MacCollom, G. V., D. R. Johnstone, and B. L. Parker
DETERMINATION AND MEASUREMENT OF INSECTICIDE DUST PARTICLES IN ATMOSPHERES ADJACENT TO ORCHARDS. Bull. Environ. Contamination Toxicol., 3(6):368-374, 1968. 2 refs.

Methods are presented for determining the effect of topography and weather on the drift of dust from aerially sprayed orchards. During field sampling at three downwind locations, downslope from the target orchard, 50 l of air were drawn through Millipore aerosol filters located 16 in. above ground level and attached to low-volume air samplers. Each filter was placed on a glass side coated with cedar oil. The number and size of particles on the exposed filters were counted by a microscope and recorded per grid square. The tabulated measurements show that particles less than 10 micron comprised the greatest percentage of total particulates collected at the maximum sampling distance. Smaller particles remained airborne for prolonged periods suitable under climatic conditions. By adding a fluorescent pigment to the dust mixture at the time of formulation, rapid visual indication was obtained of the presence of dust. This technique gave data to show the particle dust movement at specified intervals over mapped terrain during known weather conditions. However, it was determined that the presence of visually observed talc particles did not necessarily indicate the presence of the toxicant and, conversely, that the toxicant could be present in the absence of talc particles. Variables such as wind, temperature, and volatilization of the toxicant on the filter surface affected the results. Nevertheless, it is concluded that the technique permits the determination of the presence or absence of dust particles and/or the total micrograms of particulate toxicant in a known volume of air.

2967 APTIC NUMBER 20753

Madier, Pierre, Robert Regipa, and Raymond Pannetier
AIR-COLLECTING BALLOON FOR SAMPLING AIR AT HIGH ALTITUDE. (Commissariat a l'Energie Atomique, Paris (France) U. S. Pat. 3,499,326. 5p., March 10, 1970. 3 refs. (Appl. Jan. 18, 1968, 16 claims).

A method and device are presented for bringing back to the ground approximately 8 kgs of air which have been collected at altitudes between 3000 and 33,000 meters. An air collecting balloon of suitable volume which is empty and closed at the time of launching is lifted to a high altitude by a carrier balloon of any suitable type by means of a central suspension cable. The air collecting balloon is in the form of a flexible tetrahedral-shaped envelope fabricated of polyethylene, polyethylene terephthalate, glass fiber, acetate yarn, cotton yarn, or rilsan. The envelope contains a flexible inner tube filled with a measured quantity of gas. Expansion of the gas during ascent causes the inner tube to become rigid and the envelope to assume the general shape of an equilateral triangle. The balloon is also provided with a central hose which is joined to the pole of the balloon by a cone frustum and attached to a hook by means of a strainer. To prevent untimely filling of the balloon, the strainer above which the central hose is coiled, is

brought back against the pole ring during ascent. Filling at high altitude is carried out by releasing the strainer with a pyrotechnic knife ignited by a timer. The strainer moves down the axis of the central cable, accompanied by the central hose. The surrounding air penetrates into the hose and then into the collecting balloon through the strainer. During descent, the complete assembly is released and subjected to dynamic pressure. Consequently, internal overpressure flatten the central hose while the collected air is recompressed and reaches the top portion of the envelope where it remains trapped.

2968 APTIC NUMBER 20404

Magill, Paul L.
AN AUTOMATED WAY TO COUNT FINE PARTICLES. Air Eng., 4(10):31-34, Oct. 1962. 12 refs.

An automatic particle counter and sizer for commercial use is shown schematically. Airborne particles are passed through the sensing region of an optical system which is intensely illuminated by a beam of white light. The suspended particles scatter a portion of the light, a fraction of which is picked up, at 90 deg to the axis of the beam by a lens system and proceeds to a photomultiplier tube. The light pulses from individual particles are transformed to electrical pulses which are amplified and sent to upper and lower level discriminators for counting. To compensate for a loss of intensity of the light source, a mechanically pulsed light beam of calibrated intensity that uses the same optical system as employed for light scattering particles. By occasionally adjusting proper gain controls, compensation can be made for any changes in the system. Primary calibration of the instrument is most readily accomplished by admitting to the aerosol intake particles of known and uniform size. Particles traversing the light path less than 1 millisecond apart tend to be counted as a single particle. Loss of count can be made negligible for all practical purposes for particle concentrations up to 10,000 per minute in any single size range, at air-flow rates of 200 cu cm/min.

2969 APTIC NUMBER 20891

Maienthal, E. J.
ANALYSIS OF AIR POLLUTANTS. National Bureau of Standards, Washington, D. C., Microchemical Analysis Section, TN-505, p. 34-36, Oct. 1969.

To check the applicability of polarographic techniques to trace analyses, air particulate samples were collected from November to February and analyzed. The samples were collected on acid-washed membrane filters located in a laboratory and at outdoor sampling sites in residential and rural areas. For the samples taken in the laboratory, the house vacuum line was connected to the sampler and a 10 l/min limiting orifice was placed at the outlet connector of the filter holder. The sampler was placed 2 ft above the laboratory bench and the amount of air sampled varied between 20-80 cu m. A pump was used for outside sampling to provide an average flow of 25 l/ min; the flow was checked by attaching a rotometer flow meter to the filter holder. All samples were ashed in a low-temperature asher, dissolved in hydrochloric acid, and measured in an oxalic acid-ammonium hydroxide supporting electrode. Iron, copper, lead and cadmium were measured concurrently. The tabulated results, which represent the average of about 12 determinations, are generally in agreement with those obtained for similar sites in different localities. This shows that polarography is very suitable for determining metallic atmospheric contaminants.

2970 APTIC NUMBER 20657

Mammarella, Luigino
AEROSOL CASCADE SAMPLER. (Assignee not given.) U. S. Pat. 3,482,442. 5p., Dec. 9, 1969. 2 refs. (Appl. Feb. 2, 1968, 5 claims).

A sampler is proposed, having simplicity of construction and low cost, in which the aerosol components are divided in various classes of sizes with a considerable selectivity in the various classes. The sampled aerosol material can be collected on standard slides to make easy the subsequent observation under a microscope, while the material is deposited uniformly on the collecting surfaces, so that the assessment of the contamination can be carried out quickly. A considerable volume of air can be processed without having on the collecting surfaces any accumulation or agglomeration. The sampler comprises two facing hinged shells forming a parallelepipedon, the inside of which is divided by means of inclined thin sheets into a series of longitudinal chambers, each having at the upper end and at the lower end a slit on the centerline of the apparatus. Each slit has a width which is less than that of the one above, and below each slit is a sampling slide, which is housed in side grooves and kept firmly joined with one of the shells by means of spring clips. Curved thin sheets, to avoid the deposition of aerosols along the walls of the apparatus, are parelled to these slits, and the lowermost chamber is connected to a suction system. Due to the decrease in the width of the slits, the aerosol relative flow rate at each of the stages following the first one is greater than that in the preceding stage. Along the various stages of the sampler, as the height decreases, the sampling of aerosols in ever decreasing sizes can be obtained.

2971 APTIC NUMBER 20923

Mammarella, Luigi
AIR POLLUTION AND ITS DETECTION. (Inquinamenti dell'aria e loro rilevamento). Rome, Italy, Il Pensiero Scientific Publishing House, June 1966. 214 refs. Translated from Italian. Naval Intelligence Command Headquarters, Washington, D. C., Translation Div., 226p., Sept. 4, 1968.

Data on air pollution indicating its sources, mechanics of diffusion and behavior, and influence on public health and economy were compiled. The most important sampling equipment or materials were described. Air pollutants were classified as aerosols, smoke, fumes, dust, fog, smog, gases, and odors. Tests for airborne pollution included a Guecker's counter, Mumma's aerosol analyzer, Ringelman charts, and a smokescope. Aerosol collection

methods discussed were sedimentation containers, deposit gauges, filtration, centrifuging, thermal precipitation, electrostatic precipitation, and impact sampling. Sampling of gaseous or vapor phase pollution was separated into quick and precision methods. Quick methods included the peroxide weighing method and the hydrogen peroxide volumetric method. Precision methods included absorption, adsorption, freezing, and withdrawal of gaseous samples in vacuum containers. Infrared and ionization chamber analyzers were also discussed. Microbic air pollution was described. Vitality, infectiousness, and virulence of the microorganisms, variation in the number of organisms, sources, classifications of the microbe support, behavior and measurement methods were reviewed. The detection methods of airborne microbic contaminants were settling, volumetric sampling, collector funnels, multiple funnel collectors, electrostatic precipitation, thermal precipitation, impaction, impingers, filtration, and chromatic analysis of bacterial particles. Sources of radioactivity reviewed were mineral processing, nuclear reactors, and nuclear explosions. Radioactive air pollution detection methods included settling, filtration, electrostatic precipitation, adsorption and absorption, gas detectors, and solid detectors.

2972 APTIC NUMBER 21283

Matz, Juergen
THE DETERMINATION OF HYDROGEN SULPHIDE IN ATMOSPHERIC AIR. (Zur Bestimmung von Schwefelwasserstoff in atmosphaerischer Luft). Text in German. Wiss. Z. Humbolt-Univ. Berlin Math. Naturw. Reihe, 18(1):83-89, 1969. 27 refs.

The presently existing methods for determining trace substances of hydrogen sulfide in atmospheric air do yield reproducible data for concentrations below 8 micrograms /cu m. All existing methods are based on absorption of H2S on solid or liquid absorbants. Buck and Jacobs used an alkaline suspension of Cd(OH)2 for the absorption of H2S. For a study of the influence of air oxidation and the effect of light on the analysis, Jacob's methylene blue method was used as a basis. In order to obtain reproducible Cd(OH)2 suspensions as absorbents, the Cd(++) solution and sodium lye were added separately. The sulfide precipitations were not centrifuged to avoid any losses. For calibration, Na2SO5 and Na2S solutions were used. Only the latter solution proved to be suitable. A new impinger was developed which permitted all process steps from absorption to the color development to take place in one vessel. Tests with various pH of the absorbant led to the selection of an absorbing solution composed of 8.6 g (3Cd..8H20)/ liter and 2.7 g NaOH/ liter. Study of the influence of air oxidation by admitting or not admitting air showed that no measurement oxidation loss occurred. Also, the difference of extinction between constant sulfide concentration in darkened or not darkened room was negligible. The impinger was not exposed to direct sunlight, however. A second impinger filled with the same absorbing fluid was attached to the reaction impinger and defined amounts of H2S were passed through the impingers and the extinctions were measured. An average degree of absorption of 97% was obtained. Step by step operating instructions for this method are given.

2973 APTIC NUMBER 21085

McCormack, J. D.
MAYPACK BEHAVIOR IN THE CONTAINMENT SYSTEMS EXPERIMENT -- A PENETRATING ANALYSIS. Battelle-Northwest, Richland, Wash., Pacific Northwest Lab., AEC Research and Development Rept., 44p., Aug. 1969. 18 refs.
CPSTI: BNWL-1145

The Containment Systems Experiment (CSE) sampling system uses Maypacks to sample the simulated fission products which are airborne during tests to study loss-of-coolant type of reactor accidents. The Maypack consists of a particle filter, silver screens, charcoal paper, and a charcoal bed, in order of flow. The characteristics of the Maypacks to retain and differentiate between the various forms of iodine and particulate materials are reported in detail. Particle retention tests on particle filters were made with dioctyl phthalate. Sampling at a velocity of 30 ft/min did not impair the efficiency of the media, although the test run did show some evidence of bypassing the filter media. The penetration of the entire filter assembly was very low. Observations of Maypack filtering efficiencies were also made by determining the amounts of 137Cs on the filters, screens, and silver membranes in Maypacks used in several CSE runs. Filter penetration measured during actual use of the Maypack was small and not strongly affected by the humidity of the atmosphere. Fluorocarbon fiber filters had higher penetration than the glass fiber filters. It is concluded that Maypacks can form the basis of a satisfactory sampling system, that the total airborne material is well retained in a properly used Maypack, and that useful discrimination of iodine forms can be obtained. However, corrections are necessary at low inlet iodine concentrations, and some ionic forms are not uniquely identified. (Author abstract modified)

2974 APTIC NUMBER 21024

McMullen, T. B., R. B. Faoro, and G. B. Morgan
PROFILE OF POLLUTANT FRACTIONS IN NONURBAN SUSPENDED PARTICULATE MATTER. J. Air Pollution Control Assoc., 20(6):369-372, June 1970.

Analytical methods with increased sensitivity have made it possible to analyze high volume samples from non-urban areas for metal and nonmetal fractions not previously detectable. Most of the airborne particles found in urban air were also found in non-urban air. When the non-urban sampling stations are classed according to their proximity to large population centers, it is apparent that concentrations decrease with distance from the urban area through successive categories of non-urban environment to the remote or background sites. Nickel, iron, manganese, ammonium ion, and nitrate ion appear to be present at constant percentages in the remote and intermediate categories, indicating that these constituents are pervasive. Copper and sulfate ion appear to be present in relatively constant amounts in the proximate and urban categories, suggesting that these substances are invading the rural areas from urban air.

2975 APTIC NUMBER 21334

Menck, Guenter, Siegfried Baentsch, and Franz Dietrich
AUTOMATIC DATA COLLECTION DURING THE CONTINUOUS DETERMINATION OF ORGANIC AIR CONTAMINANTS. (Automatische Messwerterfassung bei der kontinuierlichen Bestimmung organischer [illegible]verunreinigungen). Text in German. Wasser Luft Betrieb, 14(4):144-146, April 1970. 22 refs.

The construction and operation of an integrator used for continuous sum determination of organic air pollutants are described. A flame ionization detector was used for measuring the total hydrocarbon content. Measuring intervals of 5, 10, 30 and 60 min were selected at the integrator. The averages of these intervals were to be printed out so that only multiplication by the factors 1, 10....100000 was necessary to obtain the concentration ppm CH4. Measurements in a busy street of Berlin were taken over a period of three weeks. The measured values were simultaneously recorded with a 2.5 mV recorder and the integrator. The readings of the two units were checked daily with synthetic air containing 6.4 and 12.0 ppm CH4. There was no significant difference in the recordings of the two units. The error of the integrator was less than 1%. Long-term operation of the integrator was satisfactory. Interruptions were solely due to errors by the flame ionization detector which had to be corrected. A modified version of the detector without thermostatization together with the integrator make a good and reliable measurement and evaluation system for continuous determination of organic substances in the ppm range.

2976 APTIC NUMBER 21207

Nakamura, Keigo
COLORIMETRIC ANALYZER. (Kashibu kyuko kodoho). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 22(2):65-68, Feb. 29, 1970. 9 refs.

A new automatic analyzer for determining atmospheric concentrations of sulfur dioxide by the West and Gaeke method provides a means to increase the temperature of the coloring solution to reduce coloring time to 0-30 min. The absorbing solution is measured by an electrode which detects the liquid level to 20 ml; the measuring circuit enables the removal of errors caused by the staining of the absorption cell or an inadequate colored light source. Measurement of the absorbing solution, aspiration of sample gas, pouring and mixing of the reagent, determination of coloring time, transmittance measurement, and rinsing of the aspiration bulb are automatically programmed and timed. The photometer is adjusted and the absorption cell (with 20 ml of solution) is allowed to reach a temperature corresponding with that of a thermostat. The sample gas is then drawn in for 60 min at 0.3-1 l/min. P-resaniline (2 ml) and Formalin solution are introduced and then coloring reagent solution is mixed with the absorbing solution. The extinction ratio of the sample absorbing solution and a comparison solution is recorded. The maximum range of measurements is 0.5, 0.3, and 0.1 ppm, respectively, for 0.3, 0.5, and 1 l/min.

2977 APTIC NUMBER 21057

Nakamura, K.
I. MEASUREMENT OF SULFUR OXIDES IN FLUE GAS. I-7 DETECTOR TUBE METHOD. (I. Haigasu chuno iosankabutsu sokuteiho. I-7 Kenchikanho). Text in Japanese. Netsu Kanri (Tokyo) (Heat Eng.), 22(2):28-33, Feb. 28, 1970. 4 refs.

The detector tube method is for rapid analysis of sulfur oxides in flue gas. The gas is pumped into the detector tube, and reagents in tablet form react chemically with the sulfur oxides. By this reaction the detector reagent undergoes a change in color which shows approximately the density of the specific element in the gas. About 70 kinds of detector tubes have been established many of which fulfill Japanese industrial standards. It is a slender glass tube with an inside diameter of about 2.5-4 mm and a full length of 130 mm. This glass tube is filled with the detector tablets and both ends are fused. When using the tube, both ends are opened and the gas is pumped in. The tablet is colored by chemical reaction of the detector reagent with the specific element in the gas. By the degree and length of coloring, density of the gas is monitored. The detector reagent is comprised of well refined silica gel, active alumina and glass beads which absorb the colorific reagent. The reaction rate influences the coloring. When the rate is high, the colored layer appears with a clear boundary from the gas entrance length of the tube as the gas is pumped in. If a fixed volume of gas is pumped in at a fixed speed, the color layer appears in proportion to the density of the specific component in the gas. When the speed is low, the clear boundary does not appear, and the detector tablet color uniformly. The density of the gas is determined by comparing the color with a standard. Factors affecting the accuracy of the measurement are discussed.

2978 APTIC NUMBER 21188

Nakamura, K.
MEASUREMENT OF SULFUR OXIDES IN FLUE GAS. I-6 IODINE METHOD. (Haigasu chuno iosankabutsu sokuteiho. I-6 Youso tenteki ho). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 22(2):24-27: Feb. 28, 1970.

The predominant sulfur oxide in flue gas produced by burning crude petroleum and coal is sulfur dioxide, which can be quantitatively analyzed by only one chemical method, the iodine method. This procedure is employed to determine the density of the standard for continuous monitoring and detector tube methods. Gas samples are absorbed in sulfaminate solution, after which sulfur dioxide is titrated by the standard iodine solution. This method which permits SO2 to be analyzed from 50 ppm to 2000 ppm, is affected by the presence of reducing substances like sulfureted hydrogen and formaldehyde, but not by nitrogen dioxide. The absorbent solution must be pH 5.4. The reagent is N/100 iodine solution and the indicator is 0.5 W/V% starch solution. Absorption appears to be chemical rather than physical. Sulfur dioxide oxidizes iodine,

which does not turn blue. After the iodine is oxidized, the excess iodine reacts on the indicator of starch and turns blue. Potassium iodide and Hi must be present for the color change to be effected. Under optimum conditions, 0.1-0.3 mg/l iodine can be detected.

2979 APTIC NUMBER 20912

Neitzel, William E.
A HIGH-VOLUME, REAL-TIME AEROSOL MONITOR. Sandia Labs., Albuquerque, N. Mex., Contamination Control and Process Acceptance Div., 18p., June 1969. 7 refs.
CPSTI: SC-DR-69-56

Research and development through three generations of a high-volume (10-50 cfm) aerosol monitor for sampling air in laminar-flow clean rooms is reviewed. The laboratory prototype of the latest monitor uses a 1-milliwatt helium-neon gas continuous wave laser as a light source. Use of the laser permits a larger light-sensing zone, which in turns allows a greater sample flow rate. Also, because of the higher intensity and coherence of the light beam, the need for parabolic mirrors is eliminated. The sensing system comprises the laser beam collimator, sensing chamber, and photomultiplier tube. A commercial vacuum with a variable control for the volume of air moved is used to pull the sample air through the intake tube. Oscillographs of pulses from the photomultiplier can be obtained without the use of any preamplifier or amplifier. The indications are that it will be feasible to measure particles 0.3 micron in size with the monitor. When coupled to appropriate electronic signal processing instrumentation, the monitor should provide accurate particle counts without the long lag in pickup detection and recording of low-volume monitors.

2980 APTIC NUMBER 21340

Neskovic, B. A. and V. Soskic
DETECTION OF SMALL QUANTITIES OF 3,4-BENZPYRENE DIRECTLY FROM CHROMATOGRAPHIC PAPER. Nature (London), 190(4782):1199-1200, June 24, 1961. 2 refs.

An extract of coal soot, previously chromatographed on an alumina and silica column, was transferred to chromatographic acetylated paper. The spots which developed on the chromatogram that showed fluorescence were set directly facing the spectrograph slit and were illuminated with Wood's light. The characteristic band spectrum of 3,4-benzypyrene was obtained from one of the spectrographed spots. (Author abstract)

2981 APTIC NUMBER 21401

Neumann, Jehuda, William Low, and Ariel Cohen
APPLICATION OF LASER TECHNIQUES TO INVESTIGATION OF CLOUDS AND PARTICLES IN THE ATMOSPHERE. (FINAL REPORT). Hebrew Univ., Jerusalem (Israel), Dept of Meteorology and Hebrew Univ., Jerusalem (Israel), Microwave Div., ESSA Contract Cwb E-100-67(N), 55p., Sept. 1969. 21 refs.
CPSTI: PB 188335

A laser transmitter-photomultiplier receiver system - the Lidar - is described, as well as a series of experiments using the system which deals mainly with the use of depolarization measurements for the study of some physical characteristics of the laser path in the atmosphere. The experimental method for the depolarization measurements and its theoretical approach are discussed, with special attention given to the determination of the depolarization factor of a clear atmosphere and its applicability to accurate distance measurements. The depolarization factor measured by pulsed laser techniques over large distances in air is about the same as that evaluated from laboratory measurements of the different molecular species; hence, the Lidar technique can be used to measure deviations of the depolarization factor because of certain atmospheric conditions and to determine in part the nature and position of the particles which contribute additionally to the depolarization. The use of depolarization data to evaluate the visibility distance and to correlate measured multiple scattered light from clouds with both size spectrum and number concentration of the cloud droplets are discussed, and a method for determining the growth process of water droplets using scattering laser light measurements in comparison with the theoretical Mie scattering curves is also described.

2982 APTIC NUMBER 20499

Nicksic, S. W. and J. Harkins
SPECTROPHOTOMETRIC DETERMINATION OF NITRIC OXIDE IN AUTO EXHAUST. Anal. Chem., 34(8):985-988, July 1962. 7 refs.

A convenient and rapid procedure for the oxidation of nitric oxide in auto exhaust to nitrogen dioxide is reported which permits determination by direct spectrophotometric absorbance measurements. A novel recording spectrophotometer for following the oxidation of nitric oxide is also described. The initial sensitivity of the method is suitable for the 0 to 3000 ppm range; by equipment adjustments, this can be more than doubled to a level greater than required for auto exhaust analysis. Even at maximum sensitivity, readings can be made to within 5% of full scale, which is equal to 0.5 ppm NO at this range. Because of the high sensitivity a highly stabilized light source is necessary, and the mechanical rigidity of the spectrometer and long-path cell are also important. The method is much faster than the phenoldisulfonic acid method commonly used, and the results of the two methods are comparable. The oxidation rate of NO to NO2 in actual exhaust samples is particularly fast at high concentrations; at the 2000 ppm level, the oxidation is essentially complete in 3 or 4 min. At the 550 ppm level, it is nearly complete in 6-8 min, while at 160 ppm, about 15 min is required for acceptable accuracy. On the basis of concentration dependence of the oxidation rate of NO as pointed out in a discussion of reaction kinetics, preliminary observations suggest that an apparatus for continuous determination could be developed by compressing and expanding the sample under empirically selected conditions prior to the spectrophotometry.

a sufficient distance from the object for the approximation of Fraunhofer (far field) diffraction to be made while still remaining in the near field of the surrounding transparent area. The resultant intensity distribution was investigated both theoretically and experimentally for objects which present both circular and rectangular cross-sections to the beam. The result was an extremely useful method of measuring particle sizes and obtaining distributions of samples of particles. If a laser is used as the light source, moving particles can be measured. (Author abstract modified)

2988 APTIC NUMBER 21404

Paulus, Harold J. and Carl M. Peterson
URBAN AEROSOL: COUNT SIZE RELATED TO METEOROLOGIC DATA. (FINAL REPORT). Minnesota Univ., Minneapolis, School of Public Health, Grant AP 00453-03, 154p., Nov. 1969. 49 refs.

A condensation nuclei counter, electrical particle counter, and light scattering particle counter were combined to develop a broad size spectrum particle counting and sizing system to continuously characterize suspended particulates. Initial performance indicates that the system is effective over the particle size range from 0.001 to about 10 micron with an apparent accuracy of plus or minus 20%. The system, which is automatic, stable, and has rapid response, was installed at a local TV tower site and operated in conjunction with meteorological sensing instruments, mass loading sensors, and gas and biological samplers. Particle number and size, wind speed and direction, vertical temperature distributions, relative humidity, precipitation, barometric pressure, direct radiation, smoke spot, and SO2 concentration were measured and recorded. The resulting data, given here, were used to study particle behavior during various weather conditions, to test the accuracy of existing mathematical models of particle size distribution, to relate particle number and mass phenomena, and to determine specific gas and microflora concentration of the ambient atmosphere at the monitoring site. The results reported for these subject areas are not considered conclusive but rather indicative of areas for future research. It is believed that the system will facilitate and increase the accuracy of aerosol research in the area of air pollution and combustion product particle sizing and counting, meteorological-particle phenomena, and filter retention studies.

2989 APTIC NUMBER 20898

Pavlenko, A. A. and T. A. Kuz'mina
METHODS OF DETECTING HYDROGEN SULFIDE AND CARBON DISULFIDE. (K metodam opredeleniya serovodoroda i serougleroda). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no. 234:188-195, 1968. 11 refs.

The colorimetric method of detecting atmospheric hydrogen sulfide in the presence of both sulfur dioxide and carbon disulfide was studied. The need for eliminating large concentrations of SO2 was established; chemosorption with sodium acetate was found effective. Colorimetric detection of CS2 in the presence of both these gases was effective when the SO2 and H2S were first removed by chemosorption with copper sulfate and sodium acetate.

2990 APTIC NUMBER 20638

Payton, Edmund James and Colin Wilson
OPTICAL DEVICE FOR THE EXAMINATION OF SMOKE AND DUST LADEN GAS. (Central Electricity Generating Board, London (England) U. S. Pat. 3,500,450. 3p., March 10, 1970. 10 refs. (Appl. June 23, 1966, 5 claims.)

It is often desirable to optically examine smoke- or dust-containing gas with light sensitive instruments. However, difficulties are encountered due to the deposition of dust on the instrument or on the window through which the observation is made. The optical probe described uses baffles to overcome this disadvantage. The invention comprises an elongated support connecting two collinear tubular portions. One collinear portion includes a light sensitive device and the other an electric bulb or similar light source. The smoke or dust-laden gas is arranged to pass upwardly between the two tubular portions and thus between the light source and the photo-sensitive device. Baffles, formed by a continuous strip as a helix, are inserted in each portion, leaving an axial light path between the source and the light-sensitive device. The baffles break up eddies in the dust-laden gas so that the dust is deposited between the baffles. When a reading is required, the light is switched on and the intensity of illumination falling on the photo-sensitive device is measured by an appropriate meter. (Author abstract modified)

2991 APTIC NUMBER 21102

Perkin-Elmer Corp., Pomona, Calif.
LABORATORY CONTAMINANT SENSOR DEVELOPMENT. (FINAL REPORT). Contract NAS 1-8258, NASA CR-66826, SPO 20227, 172p., July 1969. 3 refs.
CFSTI: N69-37578

A previously-developed closed atmosphere contaminant sensor, consisting of a mass spectrometer coupled with accumulator cells containing a sorbent material on which atmospheric contaminants are concentrated, was modified to increase its sensitivity and evaluated for capability with 55 test contaminants. The mass spectra intensity at the maximum observed in the desorption curve was linearly, related to the amount of compound sorbed. This linear relationship persisted for concentrations of less than one ppm for many compounds. For certain compounds, notably the alcohols and some sulfur compounds, there was some less in the system, so that the linear relationship failed at concentrations of the order of one to two ppm. The error of the overall process of preparing samples and analyzing them with the Laboratory Contaminant Sensor was estimated by calculating the standard deviation of the individual sensitivity measurements for each compound. The standard deviation was about 25% of the measured value, on the average. Contaminants were identified by their mass spectral patterns and to a certain extent by their desorption characteristics. For simple contaminant mixtures,the various components were identified usually by reference to the

mass spectral patterns alone. In mixtures containing many contaminants, the mass spectra of the mixture must be interpreted in conjunction with the desportion characteristics of the various compounds. Low voltage ionization has potential use in simplifying the analysis of complex mixtures. Testing of a second sensor developed during the program showed comparable results with the first system, and the technique is considered well suited for use in laboratory and spacecraft environments. (Author summary modified)

2992 APTIC NUMBER 21516

Picou, D. and J. C. Waterlow
ESTIMATION OF SMALL AMOUNTS OF SULPHATE BY PRECIPITATION WITH RADIOACTIVE BARIUM. Nature (London), 197(4872):1103-1104, March 16, 1963. 2 refs.

Because of the large volume of samples required, classical gravimetric or titrimetric methods are inconvenient for measuring total sulfate concentrations in urine. By precipitating the sulfate with barium chloride containing radioactive barium, and measuring the radioactivity in the precipitate, estimations can be made on 0.1-0.5 ml urine with an accuracy of plus or minus 2%. The sample and barium chloride reagent are mixed by shaking, allowed to stand for 1 hr, and centrifuged at 4500 rpm for 10 min. The supernatant is decanted and the tube allowed to drain. The sides of the tube and the surface of the precipitate are then rinsed with 1 ml nonradioactive barium chloride reagent. After rinsing, the activity of the precipitate is counted in a scintillation counter with a well crystal. In 21 consecutive measurements of 2-10 micromoles sulfate, the mean difference between duplicates was 1-4%. In 8 consecutive measurements of 0.5-2 micromoles sulfate, the mean difference was 3-0%.

2993 APTIC NUMBER 20405

Pinolini, P. and J. Spiers
DIESEL SMOKE: A COMPARISON OF TEST METHODS AND SMOKEMETERS ON ENGINE TEST BED AND VEHICLE. Preprint, Society of Automotive Engineers, Inc., New York, 13p., 1969. 11 refs. (Presented at the Society of Automotive Engineers Mid-Year Meeting, Chicago, May 19-23, 1969, Paper 690491.)

Smokemeters for motor vehicle engine exhausts of the makes Hartridge-B.P.; U.T.A.C; U.S.P.H.S. Beckman 912; Bosch (EPAW 65); Dunedin (EPAW 65A); Bosch (EPAW 65B); and Bosch (EPEP 534) were subjected to comparative tests on a total of 60 diesel engine vehicles. The test methods are described and the tests results are given. For constant speed, full-load conditions, smoke measurements are independent of the effects of the engine inertial and exhaust systems, and of the smokemeter characteristics when the necessary installation and operating precautions are taken. Tests carried out under constant speed, full-load conditions generally give the highest smoke density readings with naturally aspirated and mechanically supercharged engines. In these test conditions, similar results are obtained whether the engine is on the test bed or in the vehicle, whether braked by a chassis dynamometer, or controlled on the road by the vehicle brakes. In order to measure the maximum value of exhaust smoke density which is likely to be emitted by diesel engines in normal use, it is sufficient to measure the smoke emission on the full-load power curve at constant speeds. The simpliest test method is that carried out on the engine test bed. This is recommended as the basic test for prototype approval for smoke emission level. The recommended speed range for this test is between maximum speed and a speed of 1000 rpm, or 35% of maximum rated speed, which ever is the higher. This speed range applies to engines for vehicles equipped with mechanical transmissions; for vehicles equipped with automatic transmissions, the lower speed limit may be revised.

2994 APTIC NUMBER 20710

STUDIES ON THE MEASUREMENT OF THE AIR POLLUTANTS, PARTICULARLY ON THE DYNAMIC EXAMINATION OF THE ELECTROCONDUCTIVITY ANALYZER. (Dodenho ni yoru SO2 jidosokuteisochi no doteki kentei to sono mondaiten). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):23, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

A standard sulfur dioxide gas of constant concentration produced by a Teflon permeation tube was used to calibrate an SO2-autometer and to standardize the measurement method; the adsorption of sulfur dioxide by various types of filters and air intake pipes (glass and teflon) were compared. Aside from the description of the instrumentation, comparisons were made between the concentration of sulfur dioxide calculated from the reduction per unit time of the permeation tube and the actual measurements taken by the autometer using the electroconductivity method and the rosaniline formaline method. The actual measurements were lower on the average by 1.9-3.4% and 1.3-4.0%, respectively, than the calculated concentrations. In addition, some filters declined in adsorption ability after five days, although their initial quality was good. At humidity over 60%, glass intake tubes adsorbed more sulfur dioxide than Teflon tubes.

2995 APTIC NUMBER 21693

Reckner, L. R. and R. E. Squires
DIESEL EXHAUST ODOR MEASUREMENT USING HUMAN PANELS. SAE (Soc. Automotive Engrs.) Trans., 77(3):1698-1705, 1968. 13 refs.

A technique for measuring the intensity of diesel exhaust odor using a human panel has been developed and evaluated. While the ratings are primarily useful for comparative tests, the degrees of difference which can be shown to be significantly small to make the procedure adequate for practical use. A system was constructed which allowed presentation of diesel exhaust to a panel at controlled dilutions in a manner simulating on-the-street exposure. The panelists were selected on the basis of superior olfactory ability, and were trained to rate the odor of diluted diesel exhaust against a series of 12 odor intensity standards. The exhaust was diluted at the engine exhaust pipe and flowed dynamically through the presentation system to maintain its quality and intensity. The panelists were exposed to the diluted exhaust in a 1/2 cu ft sniff box for approximately 5 sec. The

standard deviations of the panelists' responses were significantly higher at 1200 and 600 dilutions. This indicated the panel ratings were less reproducible at low concentrations, and more reliable results were obtained at concentrations with higher intensities.

2996 APTIC NUMBER 20470

Reddy, K. V. S., M. C. Van Wijk, and D. C. T. Pei
STEREOPHOTOGRAMMETRY IN PARTICLE-FLOW INVESTIGATION. Can. J. Chem. Eng., vol. 47:85-88, Feb. 1969. 13 refs. (Presented at the 17th Canadian Chemical Engineering Conference, Niagara Falls, Ontario, Oct. 16-18, 1967.)
CFSTI, DDC: AD 690731

Steoreophotogrammetry was used to obtain three-dimensional information on moving particles, by measuring the local particle velocity vector and its turbulent components in two-phase solid-gas flow in a 10 cm vertical pipe. The position of t, the particles at the moment of exposure, is determined from the stereo photographs and defined in a three-dimensional coordinate system. A beam splitter was used in conjunction with a specially-designed camera, in place of a second camera normally required. To determine particle velocity vectors, double flash consecutive photographic exposures were made with a known time interval. Accuracy of the method was excellent. Stereo- and two-dimensional techniques are compared; the former gives transverse as well as axial and lateral velocity components of individual particles. The stereo technique can be used to determine the particle concentration distribution in solid-gas flows. Within the limits of the investigations, results showed that the solid phase turbulence intensities follow the pattern of the gas phase turbulence intensities; the axial velocity profile of the particles follows approximately the 1/7th power law expression; and the particle number density is approximately uniform across the pipe cross section.

2997 APTIC NUMBER 21678

Redkin, J. N.
PROPERTIES OF ATMOSPHERIC AEROSOL MEASURED WITH A CENTRIFUGAL SPECTROMETER. J. Geophys. Res., 75(18):3563-3567, June 20, 1970. 6 refs.

A newly constructed aerosol spectrometer which permits separation of particles according to values of density and Stokes radius is described. For chemically homogeneous aerosols, a pure continuous spectrum with regularly increasing radius of particles is obtained. The construction of this new aerosol spectrometer differs from those described in the literature. For separation of particles according to values of density and Stokes radius in the field of centrifugal and Coriolis forces, a radial beam of the particles is made. Tests confirm theoretical calculations. The results for the distribution of natural radioactivity on atmospheric particles as a function of radius are discussed. (Author abstract modified)

2998 APTIC NUMBER 21156

Reusmann, Guenther and Juergen Westphalen
AN ELECTROMETRIC METHOD FOR DETERMINING THE FLUORINE CONTENT IN PLANT MATERIAL. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(10):18-20, Oct. 1969. 17 refs.

A method for determining fluoride concentrations in plant materials is described. The sample is ashed and fused with sodium hydroxide. After the addition of a citrate buffer, the solution is pumped through the cells of four fluoride crystal-membrane measuring electrodes. The liquid flow recombines in the cell of a calomel reference electrode filled with sodium citrate-sodium chloride. This reference electrode exhibits a more steady potential than those filled with potassium chloride. The fluoride potential is then recorded on a digital pH meter. In order to determine the influence of interferring ions, different salt additives were added to 50 ml of a calibration solution with a concentration of 1.10 to the minus fourth power M/P(-) and the change of the potential measured.

2999 APTIC NUMBER 20905

Robinson, J. W., C. Woodward, and H. M. Barnes
DETECTION OF GASEOUS ORGANIC COMPOUNDS BY THEIR INFRA-RED EMISSION STIMULATED BY A LASER BEAM. Anal. Chim. Acta., vol.43:119-128, 1968. 9 refs.

Perkin-Elmer Model 6200 carbon dioxide gas laser was used in conjunction with an infra-red spectrophotometer to determine the emission spectra of a number of gaseous aliphatic hydrocarbons (methane, ethane, propane, n-pentane, isopentane, n-hexane, n-heptane, ethylene, and acetylene). When these spectra are correlated with bond vibrations, they are similar to infra-red absorption spectra. Whereas the only incident radiation was 10.6 micron in wave length, emission was observed over a frequency range of 3.2-15.4 micron. This method is being developed with the hope of providing a further means of analysis of atmospheric pollutants, especially as this relates to the study of these substances in their natural setting, such as when they emerge from a smokestack or at various levels in the atmosphere.

3000 APTIC NUMBER 20361

Poussel, Michel Jean and Maurice Denis Waroux
METHOD OF MEASURING THE DEW-POINT, NOTABLY OF COMBUSTION SMOKES, AND APPARATUS FOR CARRYING OUT THIS METHOD. (Gaz de France, Paris.) U. S. Pat. 3,491,583. 6p., Jan 27, 1970. 2 refs. (Appl. Nov. 29, 1966, 3 claims).

The dew point measurements of combustion smoke have conventionally been made with lithium chloride probes. These probes are cumbersome and become rapidly sooted in a smoke chimney or duct. Moreover, their use is limited; they cannot be placed in the atmosphere of an oven. The present invention permits the

continuous recording of the dew point of smokes produced in all types of installations, irrespective of the temperature of the smoke. The apparatus of the invention comprises a smoke pick-up hose, a cooling tube through which the pick-up smoke circulates, and thermometric probes, e.g., thermocouples, for measuring smoke temperatures at the inlet and outlet of the cooling tube and the temperature of the external atmosphere. To prevent smoke from condensing before it reaches the outlet section of the cooling tube, which is substantially level with the outlet thermocouple, means are provided to heat the smoke before it penetrates the tube. The heating device is an electrical heating resistance receiving current from the power output stage of an amplifier incorporated in the electronic device used to compare the temperature readings. Observed temperature discrepancies are utilized for increasing or decreasing the heating. In the absence of condensation, the temperature prevailing in the outlet section of the tube corresponds to the dew temperature of the smokes.

3001 APTIC NUMBER 21489

Sanderson, H. P., A. F. W. Cole, Morris Katz, and S. Baburek
AN IMPROVED HIGH-VOLUME AIR SAMPLER AND A WEIGHABLE SUPPORT FOR FIBRE GLASS FILTERS. Am. Ind. Hyg. Assoc. J., vol. 24:404-410, July-Aug. 1963. 6 refs.

A high-volume pump of unique design is described which is characterized by quiet operation, easy portability, and accurate air flow measurement. A novel feature of the equipment is a support for fibre glass filters which permits rapid changing of filters in the field, combined with increased accuracy in weighing the samples. The brushes in the motors have an expected life of approximately 2500 hrs running time. The unit has been used in the open atmosphere under severe weather conditions such as -35 to 95 F.; it has been operated for long periods of time at airflow rates less than 5 cfm without overheating. (Author abstract modified)

3002 APTIC NUMBER 21101

Satkiewicz, F. G., J. A. Myer, and P. Warneck
TECHNIQUES APPLICABLE TO MASS SPECTROMETRY OF GASEOUS TRACE CONTAMINANTS. (INTERIM REPORT). GCA Corp., Bedford, Mass., Technology Div., NASA Contract NAS12-641, GCA-TR-69-4-N, 99p., May 1969. 10 refs.
CFSTI: N69-38379

An experimental cryogenic target holder for the GCA prototype ion microprobe mass spectrometer was built and tested to evaluate its use in the analysis of condensed gases and vapors. The holder was cooled to temperatures of about -180 C. The materials investigated were carbon dioxide, ammonia, water vapor, and heptane. With complete coverage of the sputtering area, NH3 and H2O give rise to prolific cluster ion formation, while heptane did not. The specificity of sample-substrate interaction may have significant analytical application. The application of charge transfer as a process for ionizing a gas sample in the ion source of a mass spectrometer was investigated. Design criteria and construction details of such a source are given. Sensitivities achieved with the source are of the order 10 to the minus 8th power amps/torr for the following gases and vapors: CO2, CS2, NH3, C6H6, N2O, and SO2. The sensitivities are several orders of magnitude lower than those observed for electron impact sources; however, no pronounced disadvantage results from the lower sensitivities, since the applicable sample pressures can be higher. Resonance scattering from xenon of the 1470 A xenon resonance line was investigated with respect to its use as a calibration technique for ultra-high vacuum gauges. Optimum conditions for resonance scattering are theoretically derived, and a suitable apparatus, including light sources and detectors, is described. A microwave-powered source operated with a window close to the discharge region produced optimal scattering signals. (Author summary modified)

3003 APTIC NUMBER 20881

Sawicki E., T. W. Winfield, and C. P. Sawicki
SOLVENT EFFECTS IN PHOTOMETRIC ANALYSIS. Preprint, Public Health Service, Cincinnati, Ohio, National Air Pollution Control Administration, 116p., 1969. 205 refs.

Solvents are classified on the basis of their effect on the absorption, fluorescence, and phosphorescence spectra of conjugated organic compounds. The classification is derived from differing and interrelated solvent properties, such as dielectric constant; dipole moment; solvent polarity; acidity, basicity, or amphoteric properties; protogenic, protophilic, or amphiprotic properties; solvent polarizability; and solven pi-acid or base strength. The solvent effects are considered in terms of solvent-solute interaction in the microscopic volume of solvent concerned with the solute, with stress placed on solvent-effected changes of definite or potential use in organic trace analysis of environmental pollutants. Many techniques useful in air pollution analysis are discussed, as well as the various types of spectral bands useful in photometric analysis.

3004 APTIC NUMBER 20565

Schneider, W.
SIMPLE METHODS FOR SO2 AND SO3 DETERMINATION IN FLUE GASES. (Einfache Methoden zur SO2- und SO3-Bestimmung in Rauchgasen). (Energietechnik, 17 (12):543-546, Dec. 1967. (Presented at the Sitzung des Arbeitsausschusses 'Verfeuerung fester und Fluessiger Brennstoffe', Dresden, Sept. 28, 1966.) Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 15p., Aug. 5, 1969.

The isopropanol or absorption method of Corbett and Flint, the condensation method of the Shell laboratories, and the sodium chloride method are discussed. The equipment for the Corbett-Flint method is illustrated. Only the condensation method determines the SO3 content in flue gas accurately. The NaCl method yields approximate values. The complex sampling and analyzing apparatus for the Corbett-Flint method have no relationship to the low accuracy achieved with this method.

Sulfate containing fly dust commonly found in soft coal smoke interferes with the determinations. Sulfur dioxide can be determined at either the condensation or the NaCl method simultaneously with the SO3 by absorption in H2O2 and subsequent acidimetric titration.

3005 APTIC NUMBER 21421

Schott, W. and K. P. Schmidt
CONTINUOUS SO3-MEASUREMENT (SULFOTHERM II). (Kontinuierliche SO3-Messung (Sulfotherm II). Text in German. VDI (Ver. Deut. Ingr.) Ber., no. 149:217-224, 1970. 10 refs.

A continuously measuring and recording unit for sulfur trioxide determination in waste gases was developed. A representative sample is taken from the gas stream and water vapor is added. After cooling to the point of condensation, the electric conductivity of the condensate is measured and is representative of the SO3 content. All SO2 fractions are removed prior to the measurement. The sensitivity of the unit is greater than that of infrared analyzers and of gas chromatography. The four measurement ranges extend from 0 and 2.8 to 0 and 28 mol-ppm at standard conditions. However, the unit has a larger time constant. To avoid falsification of the measurements through oxidation of SO2 to SO3 due to the catalytic influence of metals or their corrosion products or reaction of the latter with SO3 to metallic sulfur compounds, Duran glass, quartz, and sintered aluminum oxide may be used as material for the sampling probe. For removal of particulate matter, guide vanes are installed in the sampling tube which impart a rotary movement on the gas so that the particles are thrown to the wall by centrifugal force. A membrane pump draws gas through the sampling probe into the measuring unit where two coolers are installed. In the first cooler, 99% of the sulfuric acid is precipitated. The coolers are followed by the conductivity measuring cell and a device for measuring the condensate quantity.

3006 APTIC NUMBER 21284

Schuetz, Herbert
GAS ANALYTICAL CONTROL OF REFUSE INCINERATION PLANTS. (Gasanalytische Ueberwachung von Muellverbrennungsanlagen). Text in German. Wasser Luft Betrieb, 14(4):152-156, April 1970.

To avoid excessive emission of air pollutants by refuse incinerators it is useful to measure the sulfur dioxide, sulfur trioxide, hydrogen chloride, and nitrogen oxide concentrations. One versatile method is based on the specific infrared absorption of various hetero-atomic gases. The infrared analyzer consists of two infrared radiators, the radiation of which is equal-phase modulated. The component which is to be measured absorbs part of the infrared radiation. As a consequence, the receiver chamber is less heated up than the comparative chamber which receives the full infrared radiation. The temperature difference between the receivers is a function of the concentration of the component to be measured. This method can be used for measuring CO, SO2, NO, and CO2. For measuring NO2, ultraviolet and visible light absorption from 0.2 mm to 0.8 mm is used. For measuring chlorine and hydrogen chloride, an electroconductivity analyzer is used. For measuring SO3, dew point measuring units are used. The oxygen analyzer takes advantage of the paramagnetic properties of oxygen. The concentrations are usually continuously measured. To guarantee smooth operation of the various analyzers, the gas must be sampled and cleaned, the condensate precipitated, and the interfering components removed. A measurement system for flue gas monitoring in an incinerator is illustrated and discussed.

3007 APTIC NUMBER 20976

Sehmel, G. A. and L. C. Schwendiman
PARTICLE COLLECTION EFFICIENCIES ON WIRES. In: Pacific Northwest Laboratory Annual Report for 1968 to the USAEC Division of Biology and Medicine Vol. II: Physical Sciences Part I. Atmospheric Sciences. Battelle-Northwest, Richland, Wash., Pacific Northwest Lab., p. 46-51, Nov. 1969. 17 refs.
CPSTI: BNWL-1051

Collection efficiencies of monodispersed 4 to 27 micron uranine particles were determined for 0.020 to 0.064 in diameter wires for air velocities from 8.6 to 33.1 ft/sec to determine the feasibility of using wire impactors as particle samplers near surfaces or in other situations demanding small disturbances of the sampled air. The wires were coated with a tacky film. The collection efficiencies are a complex function of particle size, wire diameter, Reynolds number, Stokes number, and wire surface area covered by previously impacted particles. For low coverage from 0.1 to 10%, an asymptotic correlation is shown as a function of Stokes number. This asymptote is near the upper experimental limit of published collection efficiency data. When greater than about 10% of the available surface is covered with particles, the collection efficiencies are less than those indicated in published correlations. The disagreement in published efficiencies may be caused by failure to account for wire surface area coverage. (Author abstract modified)

3008 APTIC NUMBER 20747

Sherwood, R. J.
MINIATURE AIR SAMPLERS FOR SULFUR DIOXIDE. Med. Bull., 30(1):32-43, March 1970. 6 refs. (Also: Am. Ind. Hyg. Assoc. J., Nov.-Dec., 1969.)

Miniature air samplers for sulfur dioxide were developed with the intention of combining the sensitivity and accuracy of installed equipment with the portability and flexibility of spot sampling instruments. The instruments are based on the principle of drawing air through a miniature bubbler by a battery-operated pump and estimating the quantity of sulfur dioxide trapped in dilute hydrogen peroxide solution by changes in conductivity. A home-assembled instrument weighs 3 1/2 lbs and measures sulfur dioxide concentrations from 0.005 to 25 ppm. As with all instruments depending on conductivity measurements, the method is not specific to sulfur dioxide, and any acid gas is determined. The instrument has been used and found satisfactory for preliminary

air pollution surveys at several sites and also for the determination of occupational exposure. The principle uncertainty in long-term field use of the equipment is the maintenance of a constant flow rate. A commercial prototype of the instrument is available. Improvements incorporated in the instrument include a choice of bubbler sizes to extend to the nominal range of concentrations that can be measured to about 1 to 1000 ppm for 1-min samples and to about 0.005 to 0.5 ppm for 24-hr samples. The instrument, which as not yet been used in the field, weighs 10 1/2 pounds.

3009 APTIC NUMBER 20264

Shigeta, Y., Y. Hoshika, S. Tsuchibashi, and T. Ishiguro
THE ESTABLISHMENT OF MEASUREMENT FOR THE BAD ODOR NUISANCES. (Akushukoga kihonchosaho no ichihoko). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):85, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The investigation of odor pollution is based on the obnoxiousness and the intensity of odor. Various mechanical odor measurement devices such as gas chromatography and infrared spectroscopy are not complete in that they do not measure obnoxiousness or low-threshold odors. In the United States, instrumental as well as organoleptic tests are used by means of an odor panel. Several suggestions are made as to the basic steps in the odor investigation. The investigation is broken down into three parts: the source, the environment and the questionnaire investigations, and some technical procedures are recommended.

3010 APTIC NUMBER 20396

Silber, Gustave
COMPARATIVE EFFECTIVENESS OF SOME EQUIPMENT AND METHODS OF MEASURING LOW CONCENTRATIONS OF OZONE. Plant Disease Reptr., 46(3):137-139, March 15, 1962. 6 refs.

Test tube-type gas impingers fitted with an intake of 1-mm capillary bore tubing or a fritted glass cylinder dispersion tube were compared for their effectiveness of ozone recovery. Impingers of 1-mm capillary tube recovered 14 to 30% more ozone than did fritted glass-tube impingers. Ozone concentration of atmosphere was secured simultaneously by a commercially available ozone meter and by chemical analysis, using neutral buffered potassium iodide solution as the collecting medium in blackened test tube impingers fitted with a 1-mm capillary bore intake. Meter readings were lower and ranged from 55 to almost 83% of values determined by chemical analysis. (Author abstract)

3011 APTIC NUMBER 21157

Simecek, Jaroslav and Eero Siltanen
INVESTIGATIONS INTO THE DETERMINATION OF THE TOTAL AND FINE-DUST CONCENTRATIONS. Staub (English translation from German of Staub, Reinhaltung Luft), 29(11):22-28, Nov. 1969. 9 refs.

To determine the total dust concentration in eight Finnish foundries, five measuring methods were employed for the determination of mass concentration and one for particle concentration. The devices used were a high-volume sampler, electrostatic sampler, membrane filter, midget impinger, two-stage cyclone and filter device, and portable pump. The methods were compared according to regression equations, correlation coefficients, and standard deviations. The comparison indicates that the gravimetric method is the most satisfactory and the portable pump method the least satisfactory. Impinger dust concentration measurements are also unfavorable and of value only for a large number of repeated measurements. The disparity between the results obtained by the individual methods for dust less than five microns is considered excessive. However, it was found that certain correlations exist between the total dust and fine-dust concentration by weight, when the same sampling method is used.

3012 APTIC NUMBER 20429

Skala, George F.
A NEW INSTRUMENT FOR THE CONTINUOUS MEASUREMENT OF CONDENSATION NUCLEI. Anal. Chem., 35(6):702-706, May, 1963. 15 refs. (Presented at the American Chemical Society Division of Water and Waste Meeting, 142nd, Atlantic City, N. J., Sept. 1962.)

An instrument is described which provides a continuous measurement of airborne particle concentrations in the size range of 0.001 micron. The concentration range of the instrument is from 10 to 10 to the 7th power particles per cu cm with a response time of 1 to 2 sec. The instrument is designed for continuous unattended operation and employs an unique dual-beam, single-phototube optical system in which the reference beam passes through the same optical elements as the measuring beam. The basic condensation nuclei (CN) counter is shown schematically. The sample is drawn at a volume rate of flow of about 100 cu cm/sec through a humidifier to bring it to 100% relative humidity. It then passes through the first section of a rotary motor driven valve into the expansion chamber. After a brief period, the second section of the rotary valve opens the expansion chamber to a source of regulated vacuum. The sudden expansion results in adiabatic cooling of the sample, causing the relative humidity to rise above 100%. Water will then condense on the nuclei present, and the resulting droplets soon grow to a size where they can scatter light. The expansion chamber contains a dark-field optical system which produces no light on the photomultiplier tube in the absence of fog droplets. With droplets present in the chamber, they cause light to be scattered to the phototube. The amount of light is proportional to the number of droplets (each containing a nucleus) and to their scattering area. The design and automatic transistorized control circuits of this instrument are described.

3013 APTIC NUMBER 20486

Skillern, C. P.
PROBLEMS USING MIE SCATTERING PHOTOMETERS FOR IN-PLACE HEPA FILTER TESTS AND AEROSOL STUDIES. Sandia Lab., Albuquerque, N. Mex.,

SC-TM-70-15, 24p., Jan. 1970. 5 refs.
CFSTI: TID -4500 (54th Ed.)

The problems encountered in applying three commercially-available instruments that use Mie light scattering to (1) in-place high-efficiency particulate-air (HEPA) filter efficiency testing, and (2) particle-size distribution studies in the industrial plant are discussed. Two of the instruments were forward light scattering aerosol photometers; the third was a right-angle scattering particle counter. A compressed-air-generated aerosol of dioctyl phthalate (DOP) was used for testing. The major problem was with the large proportion of the particles below the Mie scattering size limit of high sensitivity; the instruments studied detect only those particles greater than 0.3 micron. Thus, when a DOP aerosol is used, an electron micrograph of the aerosol should be made to determine what portion of the aerosol is effective in the light-scattering instrument. Even when the particles are in the Mie region, studies with heterogeneous materials of unknown absorption coefficient, index of refraction, and the shape are risky. Variations in these parameters are largest for particle counters that use a 90 deg photomultiplier detector angle with the scatter, and somewhat smaller for the forward light scattering instruments which use about a 20 deg angle. The greatest instrument sensitivity occurs when the photo-multiplier is placed somewhere within the 45 deg arc of the forward-scattered light. Modifications to the right-angle scattering particle counter, necessary to adapt it to the high dust loadings in studies other than aerosol-free environments, cause substantial errors in the measured particle size distribution. Frequent checking by optical and electron microscopy is essential to identify the actual particle-size distribution of the aerosol.

3014 APTIC NUMBER 20713

Smith, Albert H.
COMBUSTIBLE GAS DETECTING DEVICE. (Automation Industries, Inc., El Segundo, Calif.) U. S. Pat. 3,476,517. 4p., Nov. 4, 1969. 3 refs. (Appl. Nov. 22, 1965, 8 claims).

A gas detector is described which includes a platinum filament for producing a catalytic reaction wherein any combustible constituents in a potentially explosive mixture are oxidized while the temperature and electrical resistance of the filament are increased by a corresponding amount. This variation in the resistance of the filament may be utilized to actuate suitable signaling means to warn of presence of the combustible gas. The combustible gas detecting device comprises a chimney arranged substantially vertically and having upper and lower ends. Gas vapor inlet and outlet ports are defined at the lower and upper ends respectively of the chimney, and fine mesh Davy screens are disposed across each of the inlet and outlet ports. An electrically powered heat-emitting incandescent lamp is provided for producing a thermal siphon wherein the mixture is preheated to a stabilized level prior to detection and the heating current through the filament is regulated. Convection currents are induced in the environmental gases surrounding the detecting device and draw the gases upwardly into the chimney before the denser gases normally collect at that level, so that the earliest possible warning of combustible gases is achieved. (Author abstract modified)

3015 APTIC NUMBER 21111

Solomon, William R., Albert W. Stohrer, and Jeanne A. Gillian
THE 'FLY-SHIELD' ROTOBAR: A SIMPLIFIED IMPACTION SAMPLER WITH MOTION-REGULATED SHIELDING. J. Allergy, 41(5):290-296, May 1968. 8 refs.

By adding hinged, pendant flaps and a cam recycling timer to the basic rotobar impaction collector, a practical, simplified pollen sampler was produced. During operation, the flaps are centrifugally thrown away from the sampling edges; between periods of rotation, the flaps descend to prevent adventitious particle deposition. Calibration studies suggest that this sampler has a collection efficiency for ragweed pollen exceeding 70%; in field tests of the efficiency of sampling and of the completeness of shielding, the performance of this device compared favorably with that of an intermittent rotoslide sampler. The lower construction cost and comparatively rugged components of this 'fly-shield' rotobar sampler also favor its potential usefulness for the allergist. (Author abstract modified)

3016 APTIC NUMBER 20647

Soltau, J. P. and K. Campbell
THE SAMPLING AND MEASUREMENT OF EXHAUST EMISSIONS FROM MOTOR VEHICLES. Eng. Rev., 7(4):124-136, Dec. 1969. 4 refs.

All vehicle emission legislation or proposed legislation is based on the measurement of selected gas components when the vehicle is driven in a certain predetermined drive. The continuous monitoring of exhaust gas required by American standards limits analytical instruments to the nondispersive infrared (NDIR) type. Because of their consistency and specificity, the instruments have also been accepted for European test applications, even though the proposed European standard does not specify continuous analysis. A NDIR analyzer is almost ideal for measuring CO and CO2 concentrations, but NIDR results for hydrocarbons are arbitrary indicators and do not necessarily reflect true hydrocarbon concentration. Better results are obtained with flame ionization detectors, which may be specified in future controls. At present, there is no completely satisfactory method for determining nitrogen oxides in exhaust gas. However, NIDR instruments can be used for measuring NOx by incorporating a suitable detector and length of cell. It is likely that future legislation will establish maximum allowable pollution values in terms of weight emitted during a particular cycle, not in terms of volume percentage or ppm. The weight can be obtained by bag sampling of variable dilution sampling. Although very accurate calibration is required, NDIR analyzers are used to measure the components collected by the variable dilution method. Adoption of a standard based on exhaust gas reactivity could make future testing even more complicated. The development of a standardized technique is one of the goals of the British Technical Council Analytical Methods Committee, whose work to date is reviewed.

3017 APTIC NUMBER 20655

Sporek, Karel F.
IONIZATION DETECTOR ELECTRODE ASSEMBLY AND METHOD OF ANALYZING GAS AND VAPOR SUBSTANCES. (Owens-Illinois Glass Co., Toledo, Ohio) U. S. Pat. 3,478,205. 10p., Nov. 11, 1969. 6 refs. (Appl. July 29, 1965, 24 claims).

An improved and more economical ionization detector for gas chromatographic apparatus is described, utilizing a source of ionization radiation which is easily handled, less dangerous, and eliminates heavy shielding. It comprises a container or body having walls of an electrically non-conductive material, such as glass, glass-ceramic, and ceramic, and it includes a central ion collecting electrode which extends through the container so as to be co-axially centered and aligned with the axis of the inlet passage. Gases and vapors flowing through the inlet passage are directed toward and make contact within the container with the free or unsupported end of the collecting electrode. An annular second electrode is concentrically and symmetrically disposed in the container about the collecting wire electrode. Gases and effluent from a chromatographic separation column exit from the chamber of the container through an outlet vent or passage in the wall adjacent to the locations through which the electrodes extend through the wall. The ion current detecting electrode assembly is not in physical contact with the radioactive source, preferably promethium 147 encased in a small glass bead. Argon and helium may be used as the carrier gas. In the case of helium, the detector operates as an electron capture detector.

3018 APTIC NUMBER 21411

Stephens, Edgar R. and Monty A. Price
SMOG AEROSOL: INFRARED SPECTRA. Science, 168(3939):1584-1586, June 26, 1970. 6 refs.

A technique for comparing synthetic aerosols with natural smog aerosols by infrared spectrophotometry is described. Infrared spectra of smog aerosol are similar to those of of sulfuric aerosol, but they do no show the prominent hydrocarbon and carbonyl bands of organic aerosols from terpenes. Some features of the smog aerosol spectra are not present in the spectra from either type of synthetic aerosol. The reactions studied were those of higher-molecular-weight olefins, either with ozone or with nitrogen oxides and solar ultraviolet radiation, and the reaction caused by ultraviolet radiation of hydrocarbons, nitrogen oxides, and sulfur dioxide.

3019 APTIC NUMBER 20463

Stevens, R. K. and A. E. O'Keeffe
MODERN ASPECTS OF AIR POLLUTION MONITORING. Preprint, National Air Pollution Control Administration, Cincinnati Ohio Div. of Chemistry and Physics, 24p. 1969. 8 refs.

Air pollution monitoring instruments in use today will gradually be replaced by more reliable ones over the next 5 years. For example, several wet chemical methods for measuring ambient concentrations for ozone and sulfur dioxide will probably be replaced for direct luminescence techniques. Although wet chemical procedures filled the early needs for measuring certain pollutants, they are often marginally sensitive and generally not specific enough to be completely reliable. Several second-generation air pollutant monitors are under development: an ozone analyzer is based on the chemiluminescent reaction of ozone with an organic dye; a SO2 analyzer is based on the chemiluminescent reaction of SO2 in a hydrogen flame; and a CO and CH4 analyzer is based on gas chromatographic principles. These new air pollution monitors may be strong contenders for adoption as standard methods. Future air pollution measuring instruments will be marked by two characteristics: simplicity of principle and commonality of components. As an example, the possibility of using semiconductor devices which are at present universally protected by an impervious coating from unwanted changes that might be caused by air contaminants is mentioned. Omission of this coating offers the opportunity to use the device as a sensor for these contaminants. An array of quasi-specific semiconductor sensors, each primarily sensitive to a different pollutant and secondarily sensitive to the others, could be used for simultaneous determination of the pollutant concentrations. Another possibility is the use of microwave absorption spectrometry of the entire air sample. (Author abstract modified)

3020 APTIC NUMBER 21425

Stoennner, A., A. Schneider, and W. Koenig
MEASUREMENT OF COAL DUST CONCENTRATIONS IN PIPELINES USING RADIOACTIVE ISOTOPES. (Messungen von Kohlenstaubkonzentrationen in Rohrleitungen mit Hilfe von radioaktiven Isotopen). Text in German. Mitt. Ver. Grosskesselbesitzer 50(2):100-104, April 1970. 10 refs. (Presented at the VGB-Fachtogung 'Kohlenfeuerungen 1970; held in Augsburg, Feb. 20, 1970; Osnabrueck - Georgsmarienhuette, March 6, 1970; and Wiesbaden, March 20, 1970.)

A device is described for dust measurement in feed ducts to pulverized coal-fired burners using a radiation source 80 mc of Sr 90. A beta-chamber filled with 10 atm Ar was used as receiver. Although dust density measurements of flowing media with the aid of radioactive isotopes are nothing new, the influence of the size of the opening in the feed duct on the side of the radiation source as well as on the receiver side were studied at constant and varying lengths of the measurement path. The influence of the size of the opening was slightly higher on the receiver side. The openings in the feed duct were closed with two layers of foil. A light barrier was installed between the two layers which would release an alarm in case the foil sealing off the radioactive isotope was damaged. Use of this set-up under true operating conditions revealed great accuracy. The rather simple method can be used for continuous measurements.

3021

APTIC NUMBER 21533

Stratmann, Heinrich and Dieter Rosin
INVESTIGATIONS INTO THE SIGNIFICANCE OF AN EMPIRICAL CHARACTERISTIC MAGNITUDE FOR DESCRIPTION OF THE FREQUENCY DISTRIBUTION OF SO2 CONCENTRATIONS IN THE ATMOSPHERE. Staub (Duesseldorf), 24(12):520-525, 1964. 12 refs. Translated from German. Below and Associates, Denver, Colo., 11p., April 1, 1970.

An empirical characteristic calculated only from the individual concentrations above the arithmetic mean is used to describe the frequency distribution of sulfur dioxide concentrations. This empirical characteristic, 'so', is identical to the standard deviation, 's', of individual values in the case of normal distribution; however, it deviates more markedly from 's' the more asymmetric the distribution. A comparison between distributions found at 20 measuring places and those calculated from 's' show a statistically valid agreement. The empirical characteristic can therefore be employed to assess a breach of emission limits. (Author summary modified)

3022

APTIC NUMBER 21708

Stratmann, H. and B. Prinz
STATISTICAL VIEWPOINTS OF AIR QUALITY MEASUREMENTS. (Statistische Gesichtspunkte bei der Messung luftverunreinigender Stoffe in der Atmosphaere). Text in German. VDI (Ver. Deut. Ingr.) Ber., no. 149:212-217, 1970. 5 refs.

Stationary continuous air quality measurement provides an uninterrupted succession of discontinuous data and the total emission characteristic of the measuring station. Discontinuous non-stationary measurement yields information on the spatial emission concentration, while random sampling has the advantage of requiring very little equipment. The averages obtained by this method vary depending on the type of sampling. In order to reduce this to a minimum, the entire area which is monitored is divided into sampling points spaced 1 km apart. Superimposed on this measuring grid are so-called reference points spaced 16 km apart where continuous measurements are taken. If the arithmetic average is used as the parameter characterizing pollution situations, then the well-known technique of confidence interval estimates must be applied. Through correlation analysis the relationship between various pollution components can be determined or measurements can be limited to particular pollutants.

3023

APTIC NUMBER 21050

Stromberg, Lars Erik and Gunnar Widmark
QUANTITATIVE DETERMINATION OF 3,4-BENZOPYRENE IN THE AIR NEAR GAS-WORKS RETORTS. J. Chromatog., 49(2):334-340, June 3, 1970. 9 refs.

Extracts of industrial air particulates were purified by two-dimensional thin layer chromatography (TLC) and analyzed for 3,4-benzopyrene by gas-liquid chromatography (GLC) and ultraviolet absorption spectroscopy. To reduce losses in the purification procedure, 10 by 10 thin-layer plates were used. To reduce fluctuations in the sensitivity of the electron capture detector of the chromatograph, the heating system of the detector was modified to insure a constant temperature. Injector and detector temperatures were 220 and 185 deg, respectively. The amounts of 3,4-benzopyrene in the TLC fractions and deviations from mean values were analyzed with two detector channels, while values of absorptivities for the fractions at maximum and minimum wavelengths were found by absorption spectroscopy. The mean recovery values were determined by subtracting the mean values obtained for three fractions from the corresponding total values. All measurements are tabulated. The results show that the GLC system is the major source of statistical errors in determinations of 3,4-benzopyrene with the combination of TLC-GLC described. On the thin layer, some of the 3,4-benzopyrene is only eluted by the mobile phase of the second direction. This effect may explain, to some degree, the systematic error of the TLC system.

3024

APTIC NUMBER 21319

Sturla, Piero
INSTRUMENTATION, METHODOLOGY, AND PRACTICAL ASPECTS OF AIR POLLUTION CONTROL. (Strumenti, metodologia, possibilita practica di controllo dell'inquinamento atmosferico). Inquinamento, 7(2):18-20, April 1970.

Two possibilities are examined for establishing an air pollution monitoring network: 1) an area where the pollution can be traced to a single important source; and 2) an area polluted from many sources that cannot be distinguished from one another, but must be dealt with as a totality. A monitoring network should consist of the following basic equipment: 1) a recording anemograph, preferrably installed at the same altitude as the emission source, but usually located on top of the highest edifice available in the area; 2) a thermohygrograph, which measures temperature and humidity at ground level; 3) a recording barometer that monitors ground level pressures; 4) a pair of maximum and minimum thermometers; 5) a series of instruments that detect and record the sulfur dioxide content; and 6) a series of instruments to measure the dust content of the atmosphere. Adequate measurements of SO2 has been hindered by a lack of commercially available instruments with the necessary sensitivity (concentrations of 0.05-0.1 ppm) and that are not activated by other substances in the air. A British instrument, the EEL meter, has a measuring range of 0-0.4 ppm and a sensitivity of 0.01 ppm. The EMEL central laboratory of Piacenza has modified this instrument so that it is capable of fully automatic operation. Instruments made by Leeds and Northrup and by Beckman Instruments of the USA are critically discussed. The most recent development is the PW 9700, made by Philips, which makes use of potassium bromide and bromine, and id equipped with a filter to eliminate dust, ozone, hydrogen sulfide, an other pollutants. The provincial laboratory of Milan has tested the instrument and found it satisfactory. Its practical sensitivity is 0.01 ppm, over a range of 0.4 ppm. Its selectivity is effective for less than 5% nitrogen oxides, less than 1% ozone, hydrogen sulfide, aldehydes, benzene, and chloroform, and less than 2% ethylene and chlorides. The available instrumentation for measuring dust remains inadequate, five years after the beginning of a systematic antipollution campaign.

3025 APTIC NUMBER 21056

Takahashi, Akira
ELECTROCONDUCTIVITY ANALYZER. (Taikichu no SO2 sokuteiho. 3. Yoeki dodenritsuho). Text in Japanese. Netsu Kanri (Tokyo) (Heat Eng.), 22(2):50-54, Feb. 28, 1970. 1 ref.

An electroconductivity analyzer was adopted to monitor sulfur oxides in a specified area in conformity with the requirements of the air pollution prevention law. The conductivity of an absorbent reaction solution is increased by sulfuric acid, which is formed by a reaction of hydrogen peroxide with the sample atmosphere. The density of the sulfur oxides is measured as an increase in conductivity. Measurement can be intermittent, automatic, or continuous. In one procedure the reagent used is a solution of 0.006% H2O2 and .00005 N sulfuric acid. The reagent will last for 20 days if 20 liters are used. A recorder can simultaneously measure the oxidized sulfur substance and floating gas. Sampling should be made to extract a representative sample of atmosphere at a specified district.

3026 APTIC NUMBER 20651

Terabe, M., S. Yamada, and S. Sato
CALIBRATION OF NO2-AUTOMETER USING PERMEATION TUBES. (Permeation tube ni yoru NO2 jidokiro kukei no kosei ni kansuru kenkyu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):43, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society Air Pollution, 1969.)

Low-concentration nitrogen dioxide gas from an NO2 permeation tube was used to calibrate an NO2-autometer by comparing its values with the Saltzman method. The mechanical connection of the entire system of permeation tube production of nitrogen dioxide is presented. The gas was analyzed by Saltzman method as well as the autometer and the results were compared to the values calculated from the decrease in weight of the tubes; the two values for tube No. 1 and tube No.2 are presented. The autometer measurement from the first tube was about 90.3% of the calculated value, and the first tube and the second tube (for NO) together yielded 131.5% of the calculated value, implying that in measuring nitric oxide in tube No. 2, the leftover nitrogen dioxide from tube No.1 was added on. With the problem of NO to NO2 oxidation, there are more studies necessary on measurements by autometers.

3027 APTIC NUMBER 21636

Thomas, J. F., M. Mukai, and B. D. Tebbens
A GEOMETRICAL ASPECT OF FLUORESCENT SPECTROSCOPY. Nat. Cancer Inst. Monograph, no. 9:127-133, Aug. 1962. 6 refs. (Presented at a Symposium on the Analysis of Carcinogenic Air Pollutants, Cincinnati, Ohio, Aug. 29-31, 1961.)

Fluorescent spectroscopy is a valuable tool for both qualitative and quantitative measurements of individual fluorescent components in polluted atmospheres. Unfortunately it is very difficult to interpret results because variations in the optics and geometry of the measuring system result in large variations in fluorescent spectra. Many of these variations and their causes are discussed. A general expression has been developed that relates fluorescent energy to incident energy over a wide range of concentrations. The expression covers the Beer-Lampert law region through the concentration quenching region. Graphical comparisons of calculated and observed values of fluorescent intensities are given for anthracene, benzo(a)pyrene, and perylene in cyclohexane. (Author abstract modified)

3028 APTIC NUMBER 21637

Thomas, Jerome F., Bernard D. Tebbens, Eldon M. Sanborn, and James M. Cripps
FLUORESCENT SPECTRA OF AROMATIC HYDROCARBONS FOUND IN POLLUTED ATMOSPHERE. Intern. J. Air Pollution, 2(3):210-220, March 1960. 9 refs. (Presented at the American Chemical Society, Air Pollution Symposium, 136th National Meeting, Atlantic City, N. J., Sept. 1959.)

Fluorescent analysis has only become practical since recent instrumentation development has facilitated the attainment of smooth continuous fluorescent curves. The majority of reported fluorescent analytical information has been obtained by means of a spectrograph; information on smooth continuous fluorescent curves is practically nonexistent. A method for obtaining smooth fluorescent curves directly from paper chromatographs is presented. The limitations inherent in fluorescent analysis, both qualitative and quantitative, are exemplified. Smooth fluorescent curves of compounds obtained from polluted atmospheres are shown and compared with compounds of known composition. Fluorescent spectrometry requires only very small quantities of material for analysis. (Author abstract modified)

3029 APTIC NUMBER 21356

Thompson, Brian J., George B. Parrent, John H. Ward, and Bruce Justh
A READOUT TECHNIQUE FOR THE LASER FOG DISDROMETER. J. Appl. Meteorol., vol. 5:343-348, June 1966. 10 refs. (Presented at the 247th National Meeting of the American Meteorological Society, Washington, D. C., April 1965.)

The laser fog disdrometer for ground measurements of fog provides a reliable and direct method of determining particle size distribution. The basic principle of the method consists of illuminating a sample volume of particles with a coherent beam of quasi-monochromatic light. Diffraction patterns are photographically recorded in a plane in the far field of the individual particles but in the near field of the whole sample volume. A distinctive Fraunhofer diffraction pattern with a coherent background is associated with each individual particle and occurs at the location of the particle as projected onto a plane perpendicular to the optical axis of the system. The principle can be utilized to sample finite volumes without dilution. Originally the readout of the photographic record was made directly by measuring characteristics of the diffraction

pattern. The method has been modified to create a three-dimensional image of the sample volume, and is now a two step process. In the first step, a hologram is formed by using a ruby laser to 'freeze' the motion of particles. The second step is a reconstruction process in which the film record of step one is illuminated by the coherent beam of quasi-monochromatic light. The three-dimension image obtained is then inspected to determine particle size, shape, and distribution. The new readout technique is discussed from both a theoretical and experimental point of view. Typical experimental results are illustrated.

3030 APTIC NUMBER 21405

TRW Systems Groups, Redondo Beach, Calif.
AIR QUALITY DISPLAY MODEL. NAPCA Contract PH 22-68-60, 196p., Nov. 1969. 26 refs.
CFSTI: PB 189194

The use of a computer program designed to estimate the seasonal or annual distribution of sulfur dioxide and particulate concentrations for a specific region is described. The AQDM program is written in FORTRAN IV (level G) and is designed for an IBM 360/40 or equivalent computer. Through mathematical simulation of the atmospheric diffusion process, the program determines the estimated arithmetic average pollutant concentrations at ground level over an annual period, which are then used to produce isopleth maps giving a complete regional picture of air quality. To provide a direct comparison with air quality criteria, AQDM includes a statisitical model for transforming average concentration data from a limited number of receptor points into expected geometric-mean and maximum-concentration values for several different averaging times. For each pollutant, the user may select a basic set of up to 237 receptor locations within the region of interest. From this basic set, 12 locations may be selected to provide additional output consisting of (1) expected geometric mean and (2) expectant maximum concentrations for up to three different averaging items. For each pollutant type, the model provides a table giving the average contribution from each source to any five receptors from the basic 237. The program can also be used in an analysis of control-device effectiveness. Although the AQDM is relatively simple to use, the accuracy of its results depends strictly on the degree to which the input data-AQDM combination represents the physical situation within the region of interest. (Author introduction modified)

3031 APTIC NUMBER 21270

Tuthill, Edward J. and James J. Reilly, Jr.
APPARATUS FOR CONTINUOUS CHROMATOGRAPHIC SEPARATIONS. (Atomic Energy Commission, Washington, D. C.) U. S. Pat. 3,482,376. 4p., Dec. 9, 1969. 2 refs. (Appl. June 26, 1968, 3 claims).

A device for performing continous chromatographic separations of mixtures of liquids or gases is described. It consists of a slab-shaped chamber filled with particulate chromatographic adsorbent, preferably aluminum oxide, with the first and second axes larger than the third. The carrier fluid flows along the first two axes, without removing the adsorbent material, to separate the components on one of the planes. The individual separated components are recovered as they leave the chamber. Heating coils immersed into the chromatographic bed regulate the temperatures of the aluminum oxide particles.

3032 APTIC NUMBER 20937

QUANTITATIVE DETERMINATION OF HYDROGEN CYANIDE IN THE AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:15-18, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

A method for the determination of hydrocyanic gas in the air of industrial premises for sanitary control purposes was described. In an alkaline medium and in the presence of sodium tetrathionate at 5-55 deg, hydrocyanic acid and its salts form sodium thiocyanide. In the presence of iron chloride, the latter forms iron thiocyanide which possesses red or yellowish-red color. Hydrogen cyanide concentration is determined colorimetrically by the intensity of the iron thiocyanide solution. Air is aspirated at a rate of 25 l/hr through consecutive absorbers containing 5 ml of 0.1N NaOH solution. The sample (3.5 ml) is placed in a colorimetric tube. The standard scale is simultaneously prepared. To all the tubes, 0.15 ml of 10% ammonia solution and 0.5 ml of sodium tetrathionate solution is added. The tubes are mixed well and heated for 5 min on a waterbath at 50-55 deg and cooled to room temperature. After cooling, 1 ml of 4 N nitric acid solution and 0.2 ml of iron chloride is added to all the tubes, mixed, and colorimetrically compared at once. The color of the iron thiocyanide will keep for 10-15 minutes. The sensitivity of the method is 2 mg per colorimetric volume. The presence of acetates, sulfides, and sulfites interferes with the determination.

3033 APTIC NUMBER 20938

QUANTITATIVE DETERMINATION OF METHYL ALCOHOL VAPOR IN THE AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:59-64, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

A method for the determination of methyl alcohol vapor in the air of industrial premises for sanitary control purposes was described. The method is based on the fact that methyl alcohol is oxidized to formaldehyde by potassium permanganate in an acid medium and the formaldehyde is determined by the fuchsin sulfate method. The air is aspirated through two consecutively connected absorbers, each containing 10 ml of distilled water, at a rate of 15 l/hr. One and five ml portions of the absorber solution from the first absorber and 5 ml from the second absorber are placed into colorimetric tubes. Four ml of fresh absorber solution is added to the colorimetric tube containing 1 ml of sample. The standard scale is simultaneously prepared. One ml of 1:3 solution of sulfuric acid and 0.5 ml of potassium permanganate solution is added to all the tubes, shaken, and allowed to stand for 5 minutes to complete oxidation. Potassium

sulfate is added a drop at a time to the control tube of the standard set while shaking it; then an excess of potassium permanganate is added to complete discoloration. An identical volume of potassium sulfite is added to all the other tubes. One ml of fuchsin sulfate reagent is added to all the tubes and shaken. Reaction will occur in 20 min in tubes containing 0.2 mg or more of methyl alcohol. Experience indicated that after 30-40 min, the intensity of the developed color was best for colorimetric determination. The sensitivity of the method is 20 mg per colorimetric volume. The method is not specific for methyl alcohol in the presence of other organic compounds forming formaldehyde under similar reaction conditions. The presence of formaldehyde as such up to 0.1 mg does not interfere with the determination.

3034 APTIC NUMBER 20941

QUANTITATIVE DETERMINATION OF HYDROGEN SULFIDE IN THE AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:8-11, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

A method for the determination of hydrogen sulfide in the air of industrial premises was described for sanitary control purposes. The method is based on the fact that hydrogen sulfide is absorbed from the air by sodium arsenate dissolved in a solution of ammonium carbonate. A stable ammonium sulfate solution is formed which is converted to a silver sulfate by the addition of silver nitrate. The silver sulfate solution is rapidly reduced to silver sulfide, imparting to the solution a yellowish-brown color. The intensity of the color varies with the amount of silver sulfide in the solution. The air is aspirated through 10 ml of absorber solution at the rate of 15-20 l/hr using two consecutively connected absorbers. Each absorber solution is analyzed separately. For the analysis of the content of the first absorber, 1 ml and 5 ml of the solution are used as well as 5 ml from the second absorber. Where 1 ml of the tested solution is used, it should be diluted to 5 ml by the addition of 4 ml of fresh absorber solution. A standard scale is simultaneously prepared. One drop of starch solution and 1 drop of silver nitrate solution is added to all the test tubes containing samples and standards scale and determined colorimetrically. The sensitivity of the method is 2 mg in the analyzed volume. Hydrogen sulfide and sodium sulfide become rapidly oxidized in solution; therefore, sodium thiosulfate should be used in preparing the standard scale. In the presence of silver nitrate, sodium thiosulfate forms silver thiosulfate which rapidly breaks down to silver sulfide in acid solution. The method is specific for hydrogen sulfide.

3035 APTIC NUMBER 20942

QUANTITATIVE DETERMINATION OF AMMONIA IN THE AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:2-5, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

A method for the determination of ammonia in the air on industrial premises for sanitary control purposes was described. The method is based on the fact that in the presence of ammonia, Nessler's reagent forms dimercuric ammonium iodide which imparts to the solution a yellowish-brown color. Ammonia is aspirated through two Petri absorbers at the rate of 1 l/min. Each absorber should contain 10 ml of 0.01 N sulfuric acid. The content of each absorber is analyzed individually. Five ml of the solution from the Petri absorber is placed into colorimetric tubes. A standard series is also prepared. To all the test tubes and the standard scale, 0.5 ml of Nessler's reagent is added. The tubes are then agitated for 5 min and compared to the standard scale. The final concentration of ammonia in the air is determined by adding the results obtained for both absorbers. The sensitivity of the method is 1 mg per colorimetric volume. Salts of ammonia, hydrogen sulfide, aldehyde, and some amines of the aliphatic order interfere with specificity of the determination.

3036 APTIC NUMBER 20943

QUANTITATIVE DETERMINATION OF SULFUR DIOXIDE IN THE AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:5-7, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

A method for the determination of sulfur dioxide in the air of industrial premises for sanitary control purposes was described. Sulfur dioxide is oxidized to sulfuric acid and determined as lead sulfate in a water-alcohol medium. Sulfur dioxide is absorbed by aspirating the air through two consecutively connected absorbers which contain 5 ml of potassium chlorate solution. The rate of aspiration should not exceed 25 l/hr, and between 2-3 l of air should be aspirated. The content of each absorber is analyzed separately. Five ml of alcoholic lead nitrate solution is placed into colorimetric tubes with 2 ml of the sample. The tubes are thoroughly shaken. A standard scale is also prepared at the same time. The tubes are then allowed to stand for 10-15 min. The turbidities are compared against a black background. The final concentration of sulfur dioxide is obtained by adding the results from the two absorbers. The sensitivity of the method is 2 mg SO2 per analyzed solution volume. Hydrogen sulfide interferes with the determination.

3037 APTIC NUMBER 20944

QUANTITATIVE DETERMINATION OF MERCURY VAPOR IN THE AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:30-33, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

A method for the determination of mercury vapor in the air of industrial premises for sanitary control purposes was described. The method is based on the fact that the formation of CuIHgI2 in solution is accompanied by the development of a red color. This compound becomes mixed with the simultaneously formed copper iodide; in the presence of mercury, it also forms a colorless substance. The air is aspirated at the rate of 2 l/min through two consecutively placed absorbers, each containing 10 ml of absorber solution. The content of each absorber is analyzed separately. The absorber solution is poured into a 10 ml cylinder graduate. The glass absorber is rinsed with a small amount of

water and poured into the same cylinder graduate. Fresh absorber solution is added to obtain a total of 10 ml of solution. Five ml of the solution from each 10 cylinder graduate is placed in separate centrifuge tubes. A standard scale is prepared at the same time. One ml of the composite solution is added to all the tubes and shaken cautiously. The solutions then are allowed to stand for 5-10 min to complete the precipitation of CuIHgI2. The precipitates in the centrifuge tubes are then colorimetrically compared. The sensitivity of the method is 0.3 mg of mercury in the analyzed volume. The reaction is nonspecific in the presence of mercuric chloride or organic mercury compounds.

3038 APTIC NUMBER 20965

QUANTITATIVE DETERMINATION OF LEAD AND ITS COMPOUNDS IN THE AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:34-38, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

A method for the determination of lead and its compounds in the air in industrial premises for sanitary control purposes was described. The method is based on the fact that the degree of turbidity formed by the interaction between lead ions and potassium chromate increases with the increase in the lead ion concentration. The air sample is aspirated through ash-free and lead-free filter paper, or through lead-free perchlorvinyl fiber filters placed in an adapter at a rate of 20 l/min. The paper or perchlorvinyl filter is removed from the adapter, placed into a porcelain dish or crucible, moistened with 1-2 ml of H_2SO_4 and HNO_3 mixture, and heated over a sandbath until a solid residue is formed. The porcelain dish or crucible is placed into a muffle furnace at a temperature of 450-550 degrees. At the end of incineration, the dish is covered and allowed to cool to room temperature. Four to six ml of 3% ammonium acetate is added until the ash is completely dissolved. The ash solution is poured into a centrifuge tube and centrifuged lightly. The supernatant should be clear and colorless. Two to five ml of the solution is removed with a graduated pipette and placed into a colorimetric tube. The standard scale is prepared. To all the tubes, 0.1 ml of 1% potassium chromate solution is added and allowed to stand for 15-20 minutes. The tubes are then compared colorimetrically against a dark background. The sensitivity of the method is 1 mg of lead in the analyzed solution volume. The method is not specific in the presence of barium salts.

3039 APTIC NUMBER 20964

QUANTITATIVE DETERMINATION OF CARBON BISULFIDE VAPOR IN THE AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:11-15, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

A method for the determination of carbon bisulfide in the air of industrial premises for sanitary control purposes was described. The method is based on the fact that in the presence of copper acetate, carbon bisulfide reacts with diethylamine or with piperidine to form dithiocarbamate of copper which has a yellowish-brown color. Air is aspirated through two consecutively connected absorbers at a rate of 30 l/hr, which contains 10 ml of 1.5% alcoholic solution of diethylamine or piperidine. Absorbers must be submerged into ice water while the air samples are collected. The content of each absorber is analyzed separately. One ml and five ml from absorber No. 1 and 5 ml from absorber No. 2 are placed into separate colorimetric cups. Four ml of fresh absorber solution is added to the colorimetric tube containing 1 ml of sample. A standard scale is simultaneously prepared. To all the tubes, 0.5 ml of 0.05% of alcohol solution of lead acetate is added, shaken for five minutes, and compared colorimetrically. The sensitivity of the method is 0.5 mg per analyzed solution volume. The method is non-specific in the presence of hydrogen sulfide or thiocetic acid.

3040 APTIC NUMBER 20967

QUANTITATIVE DETERMINATION OF CHROMIC ANHYDRIDE (CHROMIUM TRIOXIDE, CrO_3) AND SALTS OF CHROMIC ACID IN THE AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:38-41, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

A method for the determination of chromic anhydride and salts of chromic acid in the air of industrial premises for sanitary control purposes was described. The method is based on the appearance of a red color resulting from the reaction between solutions of chromic acid or its salts and diphenylcarbazide. The intensity of the color varies directly with the concentration of chromic acid or its salts in solution. The air is aspirated at the rate of 10 l/min through a paper or perchlorvinyl fiber filter in an adapter. The filter is transferred from the adapter to a porcelain dish and 3 separate 5 ml portions of distilled water heated to 80-90 deg are added. Each 5 ml portion of water is drawn off by vacuum suction. The wash water portions are placed in a 15 ml graduated cylinder and distilled water is added to the 15 ml mark. The standard scale is simultaneously prepared. One ml of diphenylcarbazide is added to each of the test and standard scale tubes. The chromium concentration is photocolorimetrically determined using a green light filter at a distance of 30 mm. The sensitivity of the method is 1 mg in the analyzed solution volume. The method is not specific. The presence of more than one mg of iron or more than 8 mg of molybdenum in 10 ml of the solution interferes with the determination. The presence of manganese did not interfere with the determination.

3041 APTIC NUMBER 21089

QUANTITATIVE DETERMINATION OF BENZENE IN THE AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:47-52, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

A method for the determination of benzene vapor in the air of industrial premises for sanitary control purposes was described. Benzene is nitrated to dinitrobenzene, and the latter determined colorimetrically in alkaline ether-acetone solution. The intensity of the developed characteristic violet color increases

with an increase in the dinitrobenzene concentration in solution. Air samples can be collected either by aspiration or vacuum suction. The contents of the two absorbers are analyzed together. Sixteen ml of distilled water is placed into a separating funnel, the used nitration mixtures from the two absorbers is added, and the absorbers are rinsed with 4 ml of water, which is also poured into the separating funnel. Four ml of the nitration mixture is poured into another separating funnel and 4 ml of water is added. Ten ml of ether is added and shaken for 3 minutes. The solution is then allowed to stand until the funnel content becomes clearly separated. The funnel stopcock is opened and the lower liquid layer is removed. Ten ml of water is added to the ether layer and shaken. The wash water is removed. The ether layer is poured into a tube equipped with a ground-to-fit glass stopper. Three ml of the ether solution is poured into a colorimetric tube containing 7 ml of acetone; 1 ml of 40% NaOH is added, and the solution is shaken for 2 min. The solution is then allowed to stand for 20 min and compared colorimetrically with a standard scale which was simulatneously prepared. The sensitivity of the method is 2 mg in the analyzed solution volume. The method is not specific in the presence of nitrobenzene, chlorobenzene, toluol, xylol, and other aromatic hydrocarbons. Butylacetate, amylacetate, acetone, and butyl alcohol in quantities less than 2 mg had no effect on the colorimetric determination; in high concentrations, they affect the color reaction.

3042 APTIC NUMBER 21348

Vello, Norman and Charles H. Keith
NITROGEN OXIDES IN TOBACCO SMOKE. Nature (London), 205(4974):915-916, Feb. 27, 1965. 9 refs.

An analytical technique was developed to provide quantitative estimates of the relative amounts of nitric oxide and nitrogen dioxide in cigarette smoke. Based on the difference in their volatility, a cold absorption trap was used to separate the gases. Nitric oxide was then allowed to oxidize to NO2 and concentrations of both were measured by the Saltzman procedure. The smoke collecting apparatus comprised a train containing an efficient particulate smoke filter, a flow-limiting orifice, a small U trap, and an evacuated terminal gas collecting flask. Experiments involved pure gases and mixtures of NO and NO2 diluted with nitrogen to the approximate level of nitrogen oxides in cigarette smoke. All nitrogen oxides in fresh, normally obtained cigarette smoke proved to be the pharmacologically less active NO, with only trace quantities of the more toxic NO2. This essential absence of NO2 may stem from conditions in the hot reducing atmosphere behind the glowing cone, which favor formation of lower oxides, or the presence of moisture and reactive organic materials in the smoke stream and tobacco column which can absorb and react with NO2.

3043 APTIC NUMBER 20622

Walters, C. L. and A. McM. Taylor
THE IDENTIFICATION AND ESTIMATION OF NITRIC OXIDE BY ITS ABSORPTION IN ALKALINE SODIUM SULPHITE. Biochim. Biophys. Acta (Amsterdam), 82(2):423-425, Feb. 10, 1964. 5 refs.

The gaseous products of the anaerobic incubation of sodium nitrite with fresh minces of pig muscle at pH 6.0 showed an increase in the absorbancy (in the ultraviolet region below 190 millimicrons) of the alkaline sulfite absorption reagent after 100-fold dilution. Mass spectrometric and infrared spectrophotometric evidence for the presence of nitric oxide in these gaseous products prompted the treatment of the alkaline sulfite reagent with this gas; again, after 100-fold dilution of the product in order to reduce the background absorption of the reagent to a negligible density, an increase of absorbancy in the ultraviolet region was obtained.

3044 APTIC NUMBER 21039

Weers, Delbert D.
AN ECONOMICAL METHOD OF CONTINUOUS COLLECTION OF AIR POLLUTION DATA IN COMPUTER COMPATIBLE FORM. J. Air Pollution Control Assoc., 20(6):405-406, June 1970.

A system for air pollution data collection is described wherein sensors are provided with the capability of producing their normal information in the form of a pulsed signal. A field data recorder records the digital data pulses and time pulses on separate channels of slow moving magnetic tape. The proposed capacity of the field recorder is one month's output of the sensor. An off-line translator converts the field recorder tape to computer-compatible tape. A digital computer, normally the user's business type of data processing computer, performs any desired analysis or manipulation of the data. Advantages claimed for the system include low initial cost, greatly reduced data collection cost, and speed of data conversion. The system is a modification of a data collection/conversion system used by utilities to generate load profile and billing data.

3045 APTIC NUMBER 20778

West, Philip W., George P. Lyles, and Jimmy L. Miller
SPECTROPHOTOMETRIC DETERMINATION OF ATMOSPHERIC FLUORIDES. Environ. Sci. Technol. 4(6):487-491, June 1970. 11 refs.

The lanthanide-alizarin complexan-fluoride reaction was investigated and an improved procedure for the spectrophotometric determination of atmospheric fluorides was derived. The suggested sampling procedure eliminates the interference of diverse ions and molecules commonly present in the atmosphere. The method involves adding standard fluoride, 10.0 ml of alizarin complexan, 10.0 ml of Ce(III), 25.0 ml of acetone, then diluting to 100 ml. The test solution is allowed to stand for 90 min, after which absorbance is determined at 618 micrometers, using 1-cm curvettes. The method has a sensitivity of 0.0019 microgram fluoride per sq cm and is reproducible within plus or minus 0.003 microgram per ml at the 95% confidence level for known fluoride concentrations of 0.400 microgram per ml. The procedure is uniquely suitable for the determination of actual fluoride concentrations in ambient atmospheres at ppb levels. (Author abstract modified)

3046 APTIC NUMBER 20505

Whisman, M. L. and Basil Dimitriades
RADIOTRACER PROCEDURES FOR MECHANISTIC STUDIES IN AIR POLLUTION RESEARCH. Bureau of Mines, Washington, D. C., Dept. of Investigations 7304, 36p., Oct. 1969. 12 refs.
CFSTI: PB 187722

Radiotracer techniques are reported for stoichiometric studies of photochemical reactions associated with atmospheric smog formation. Methods were developed for preparing and calibrating gas phase blends at a level of about 1000 ppm. These methods are applicable to low-molecular-weight materials such as ethylene and butene and to high-boiling materials such as m-xylene and 1,3,5-trimethylbenzene (mesitylene). Calibration is accomplished by combusting to convert all carbon-bearing material to CO2 and water and using a nondispersive infrared analyzer for quantitative measurement of the resultant CO2. The repeatability of this method of calibration is estimated at about plus or minus 3%. Analytical methods developed for quantitative measurement of radioactivity reaction products resulting from NOx -sensitized photooxidation of terminally bonded and labeled olefins include quantitative determination of total carbon-14 radioactivity, formaldehyde-14C, ethylene-14C, 1-butene-1-14C, isobutylene-14C, 14CO, and 14CO2. The precision and accuracy of all these determinations were estimated and are reported. With the exception of formaldehyde, the estimated precision level was about plus or minus 2%. The formaldehyde precision level was near plus or minus 3%. Further investigation failed to provide quantitative information about other radioactive reaction products such as methyl nitrate or formic acid. If these were present, they were minor constituents. (Author conclusions modified)

3047 APTIC NUMBER 20984

White, Lowell D., David G. Taylor, Patricia A. Mauer, and Richard E. Kupel
A CONVENIENT OPTIMIZED METHOD FOR THE ANALYSIS OF SELECTED SOLVENT VAPORS IN THE INDUSTRIAL ATMOSPHERE. Am. Ind. Hyg. Assoc. J., 31(2):225-232, March-April 1970. 16 refs.

Industrial hygienists have generally sampled for solvent vapors by taking grab samples or by measuring the concentrations with bulky equipment. Because a solvent vapor is rarely found by itself in an industrial atmosphere, an analysis is needed that requires a maximum of time and effort to simultaneously separate and quantitatively identify all the components in a solvent vapor mixture. An integrated sample can be conveniently taken in a glass tube packed with activated charcoal. A standard of 10 l is sampled, and the tube is capped and returned to the laboratory for analysis. The activated charcoal is desorbed with carbon disulfide, and an aliquot is introduced into a gas chromatograph equipped with a flame ionization detector. The sampling adsorption efficiency was determined to be 100% for the following solvents: benzene, n-butyl acetate, 2-butanone, carbon tetrachloride, chloroform, p-dioxane, ethanol, ethyl ether, isooctane, perchloroethylene, pyridine, toluene, trichloroethylene, and xylene. Moreover, a single charcoal tube can be used to sample and efficiently collect each of the fourteen solvent vapors at a concentration twice the current threshold limit values. (Author abstract modified)

3048 APTIC NUMBER 21063

Williams, David T. and Byron L. Kolitz
MOLECULAR CORRELATION SPECTROMETRY. Appl. Opt., 7(4):607-616, April 1968. 5 refs.

The method of spectrometric determination of gas concentration by use of a mask is described. Tests conducted on silicon tetrafluoride, ammonia, sulfur dioxide, nitrogen dioxide, benzene, toluene, and nitric oxide showed that the mask increased the difference signal used for detecting gas A as compared with the use of a single slit in place of the mask, and also discriminated between different gases having absorption in the same spectral region. In fabricating a mask, a band spectrum of some convenient gas is photographed by use of a spectrometer, and a spectrometer record is then made of the same absorption spectrum and used for making a mask on tracing paper with electrical plastic tape; the white strips coincide with the minima of the spectrometer trace. The completed mask shows transparent strips that are spaced to coincide with the absorption maxima of the gas in the region of the mask. Calibration curves of NH3, SO2, and C6H5CH3 appear to be linear in a log-log plot over ranges of path length concentration ample for practical use, and the slopes of the curves are duplicable within the limits of uncertainty of the data. This method of gas concentration determination appears to be reliable, even under the rather stringent conditions of overlapping band spectra of toluene and benzene; it is concluded that interference due to unknown pollutants will not be a problem in many situations in which mask spectrometry is used.

3049 APTIC NUMBER 20595

Wyszynska, Halina, Konrad Kosinksi, Stefan Maziarka, Z. Misiakiewicz, and Artur Strusinsky
METHODS FOR THE SANITARY INVESTIGATION OF ATMOSPHERIC AIR DEVELOPED BY THE SECTION OF SANITATION LABORATORIES FOR THE PROTECTION OF ATMOSPHERIC AIR. (Metody sanitarnego badania powietrza atmosferycznego opracowanie zespolu Pracowni Sanitarnej Ochrony Powietrza Atmosferycznego). Wydawnictwa Metodyczne Panstwowego Zakladu Higieny (Methodologic Study Govt. Dept. Hyg.), no. 4(26): issue no. 10, 149p., 1968. 78 refs. Translated from Polish. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, Oct. 14, 1969.

Methods are presented for determing atmospheric pollutants, with the exception of carbon monoxide and gasoline, the concentrations of which are defined by Polish law. In addition, methods are given for the determination of pollutants present in the atmosphere in quantities sufficient to create sanitation problems or to cause plant damage and corrosion to buildings. Some of the methods have been checked and tested extensively in the laboratory and in the

field. Others have not yet been widely tested but are included for their potential usefulness in laboratory studies. The methods include the measurement of dust collected by the deposition method with respect to tars, sulfates, free silica, heavy metals, calcium, and fluorine. The other methods are the aspiration and contact methods for sulfur dioxide; the method employing thorium nitrate and eriochromecyanin R for sulfur trioxide-sulfuric acid; the para-aminodimethylaniline method for hydrogen sulfide; methylene blue and diethylamine and copper methods for carbon disulfide; the Saltzman method for nitrogen oxides; titration with thorium nitrate and colorimetric determination with eriochromecyanin and zirconium oxychloride for fluorine; o-tolidine for chlorine; titration for hydrogen chloride; buffered potassium iodide and the Heigal method for ozone; the Schryver method for formaldehyde; para-aminodimethylaniline and diazo-p-nitroaniline for phenol; nitration for benzene and chlorobenzene; and the indophenol method for aniline.

3050 APTIC NUMBER 21055

Yamada, T., K. Nakamura, T. Kawai, S. Hirasawa, and K. Miyajima
METHOD OF MEASURING SULFUR OXIDES IN FLUE GASES. I-1. SAMPLING POSITION AND METHOD OF GAS SAMPLES FOR ANALYSIS. (Haigasu chu no iosankabutsu sokutei ho. I-1. Bunsekiyo shiryo gasu no saishu ichi oyobi hoho). Text in Japanese. Netsu Kanri (Tokyo) (Heat Eng.), 22(2):5-9, Feb. 28, 1970. 2 refs.

Sulfur oxides in flue gases are generally analyzed either by a volumetric or a colorimetric method. These methods are moderately accurate but when a concentration distribution exists on the cross section of the flue through which the gases pass, or air leaks into the pipe, accurate measurements of average density cannot be expected as long as gas samples are gathered from one point. Consequently, a regulation of the conditions for sampling gases is necessary, which is also impossible because the differences in equipment and the composition of flue gases are not equal. The result of an experiment on the sampling of flue gas is shown, using a small practical boiler as the model plant. An examination was made of how the current distribution at a spot in the pipe relates to the concentration distribution of sulfur oxides as well as the disagreement of measurements in many methods of analysis. When there is no leakage, a reliable result is obtained by sampling gas from an arbitrary point. In another experiment it was shown that when L is the length from the measuring point to the point at which air leaks occur and D is the length of one side of the pipe, the density distribution through the cross section becomes uniform at the point which a distance L/D equals 1-2 from the leak. Density becomes uniform unexpectedly soon, even when air of as much as 4% of total the volume of flue gas leaks into the pipe.

3051 APTIC NUMBER 20330

Yamada, T.
METHODS OF MEASURING SULFUR OXIDES IN FLUE GASES AND AIR. (Iosankabutsu no sokutei). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 22(2):2-4, Feb. 28, 1970.

The exact determination of sulfur oxides in flue gas and in the atmosphere is a prerequisite for plan the control of air pollution. Analytical methods recommended by the flue gas existing Japan industrial standard (K-0103) are the neutralization, thorin and barium chloranilide methods. The standard is now in the process of revision and in the future may substitute the arsenoso III method for the thorin method. Also under consideration are automatic methods of measuring sulfur dioxide, conductometric and infrared analysis methods, and the detector tube method. The sampling points and the sampling methods are of great importance when sulfur oxides in exhaust gas are measured. Calculations of the mean concentrations of sulfur oxides, or setting the sampling points in locations which indicate the mean concentration, are necessary for the enormous volume of air exhausted by sintering plants and the like. The change of driving conditions of combustion plants also determine the location of sampling points, but the sampling of sulfur oxides is easy, since their concentration is not influenced by gas speed to the same extent as smoke particles. The condensation of sulfuric acid and vapor because of decreasing concentration of gas, causes measurement errors and requires the gas pipe to be heated above 100 C. Automatic analyses determine only sulfur dioxide. Neutralization, iodometric, solution conductometric, and infrared absorption methods give about equal values for flue gas from boilers. In the case of a heavy-oil combustion plant, sulfur dioxide concentration can be calculated when the composition of heavy oil and the air rate are known. An experimental formula is used for determinating sulfur oxide concentration with regard to an air cone. Direct measurement cannot be avoided where generated sulfur oxides are absorbed by ashes and clinker. The concentration of atmospheric sulfur oxides is so low (less than 1 ppm) that analysis is complex and of low accuracy. The lead peroxide method, West-Gaeke method, and solution conductometric method are mainly used in Japan. It has been widely recognized that free sulfur dioxide does not exist in the atmosphere, i.e., it forms sulfuric acid or sulfate which are measured on the Watman No. 1 filter. Sulfur trioxide concentration must be determined by direct methods.

3052 APTIC NUMBER 21338

Yamate, Noboru, Toshiro Matsumura, and Masaharu Tonomura
AUTOMATIC CONTINUOUS ANALYZER OF LEAD IN THE ATMOSPHERE. (Taikichuno namari no renzoku jidosokuteiki mitsuite). Text in Japanese. Eisei Shikensho Hokoku (Bull. Natl. Inst. Hyg. Sci., Tokyo), no. 87:28-31, Dec. 1969. 6 refs.

An automatic analyzer for lead determinations utilizes the principle of square wave polarography. Sample air is passed through an absorbing bubbler containing 30 ml of 0.1 N nitric acid for 46 min at 22 l/min. Subsequently, nitrogen is passed through the absorbing bubbler for 3 min to remove oxygen from the solution. The sample solution is then transferred to an electrolytic cell. A high-sensitivity polarograph is employed, together with a program, to record square-wave polarograms from -0.6 to -0.85 V Hg pool. Wave heights of the recorded polarogram are converted to lead concentration (micrograms /cu m), using prepared lead calibration curves. This procedure can be repeated every hour. The detection range of the analyzer is 0 to 15 micrograms /cu m of lead.

The standard lead solution for calibration is made by dissolving 159.8 mg of lead nitrate in 1 l of 0.1 N nitric acid. Linearity and reproducibility of the calibration is satisfactory.

3053 APTIC NUMBER 20336

Yamate, Noboru
METHODS FOR DETERMINATION OF GASEOUS POLLUTANTS. (Gasujo osenshitsu no sokuteiho). Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 7:(6):5-12, March 1, 1970. 22 refs.

The determination of gaseous pollutants is reviewed with respect to their constitutients and and method of analysis. The pollutants included are total sulfur oxides, hydrogen sulfide, carbon monoxide, sulfur dioxide, nitrogen dioxide, hydrocarbons, and ozone. Both continuous and discontinous manual methods are used to analyze gaseous pollutants. The former method employs the auto-analyzer and the latter employs such devices as colorimeters. The rosaniline method is widely used for SO2 determination and solution conductometric, barium molybdate, and lead peroxide methods for the determination of total sulfate. For the latter, a detector paper method has recently been developed. Continuous measurement methods include the conductometric, the rosaniline, and the iodo starch absorptiometric methods. Hydrogen sulfide is analyzed by the methylene blue method, which is excellent in detecting sensitivity, the iodo method, and by a continuous coloring filter method. Carbon monoxide (mainly from internal combustion engine exhaust gas) is determined usually by the detector tube and by gas chromatograpic, hopcalite or iodo pentoxide methods. The measuring range of the detector tube is usually 100-1000 ppm, but is made 1-100 ppm by extending suction time. Recently a 'length-metry' type detector tube was developed; it will reduce errors. Infrared absorption has been used since 1964 in Japan for continuous carbon monoxide measurements. A new infrared analyzer measures carbon monoxide in 0.05-1 ppm. Carbon dioxide is determined by the popular detector tube or interferometer method, and by the continuous infrared absorptiometric method. Hydrocarbons which cause photochemical smog, are analyzed manually by gas chromatographic and continuously by a hydrogen flame ionization detector. Ozone is determined manually by the phenolyphthalein or coulomb titrating methods and continuously by the absorptiometric method.

3054 APTIC NUMBER 20522

Yavorovskaya, S. P.
GAS CHROMATOGRAPHY USED TO STUDY AIR POLLUTION. Gigiena Truda i Prof. Zabolevaniya, No. 1:42-45, 1969. Translated from Russian. Joint Publications Research Service, Washington, D. C., 6p., Aug. 19, 1969.
CFSTI: JPRS 48644

Among the advantages which make gas chomatography of great usefulness in air pollution and air hygiene studies are its rapidity, high sensitivity, simultaneous qualitative and quantitative determinations, separation capacity for complex mixtures, and low cost in relation to other physical instruments. A brief review of the development of the method and a description of the apparatus are given. Of the two main variants of gas chromatography (using either an adsorbent solid such as activated carbon, silica gel, and molecular screens or a liquid), the former is used primarily for separating gases. Physical and/or chemical methods are used in detection; the most widely used characteristic is the components' 'retention time'. Three methods of accumulating micromixtures of harmful substances which pollute the air are discussed: condensation of the mixture on a cooling separator; absorption in an appropriate solvent; and sorption by an adsorbent or solid carrier from the stationary liquid phase with the subsequent thermal desorption or extraction. It is suggested that the applications of gas chromatography can be greatly increased by combining it with other physical methods, including spectrophotometry and infrared and mass spectroscopy. The difficulties with the method, (relating mainly to problems of standardization), equal sensitivity to substances of different chemical groups, and calibration methods are noted.

3055 APTIC NUMBER 20576

Yavorovskaya, S. P.
GAS CHROMATOGRAPHY -- A NEW METHOD OF INVESTIGATING POLLUTION OF THE ATMOSPHERIC ENVIRONMENT. (Gazovaya khromatografiya -- novyy metod issledovaniya zagryaznennosti vozdushnoy sredy). Text in Russian. Gigiena Truda i Prof. Zabolevaniya, no. 1:42-45, 1969.

The principles and techniques of gas-solid and gas-liquid chromatography are outlined. There are no Soviet-made chromatographs especially designed for detecting air pollutants, but standard chromatographs suited for adaption to this purpose are recommended (models LKhM 7-A, KhL-4, Tsvet-2, Tsvet-3, and KhG-1302). The Czech-made Khrom-3 is also recommended, as well as instruments made by British, U. S., and Japanese firms (no models are specified). The usefulness of chromatographic methods in industrial-hygiene chemistry and toxicology is pointed out, together with limitations of these methods. A need for appropriately trained technical personnel is mentioned.

3056 APTIC NUMBER 21042

Young, J. F.
AN OPTICAL SYSTEM FOR THE MEASUREMENT OF THE DENSITY AND ROTATIONAL TEMPERATURE IN A GASEOUS PLUME. J. Environ. Sci., 13(3):26-30, May-June 1970. 9 refs.

The exhaust from the auxiliary propulsion system engine and oxygen hydrogen burner of a S-IVB engine was simulated by nitrogen gas expelled from one-tenth scale models of these engines. The system was maintained at 0.0001 Torr or less by special cryopanels in the experimental space chamber. An electron beam gun in the chamber excited optical fluorescence in the nitrogen plume; this was picked up by an optical system in the chamber and reflected to the outside where it was measured. Exterior to the chamber, the optical density was measured either directly by a photomultiplier or after dispersion by a spectrograph. These values were used to calculate density and rotational temperature, respectively.

Typical measurement results are included with a discussion of their significance. The results of the investigation indicate that electron beam capture is a valuable tool in actual low density tests where nonuniform gas density is involved. (Author abstract modified)

3057 APTIC NUMBER 20701

Yu, Ming-Ho and Gene W. Miller
GAS CHROMATOGRAPHIC IDENTIFICATION OF FLUOROORGANIC ACIDS.
Environ. Sci. Technol., 4(6):492-495, June 1970. 9 refs.

Gas chromatographic techniques are described for the separation and identification of fluoroacetate and fluorocitrate from fluoride injured plant tissue and organs of animals suffering from severe fluorosis. Methylfluoroacetate was prepared from monofluoroacetate, and trimethylfuorocitrate was prepared from monofluorocitrate. Samples of crested wheat grass were collected within 2 miles of an industrial phosphate plant, air-dried, and ground in a mill. Plants grown in a greenhouse in the absence of fluoride were used as controls. Kidneys and hearts were obtained from horses and cattle showing severe fluorosis. Tissue was extracted with 95% ethanol in a Soxhlet apparatus. The methyl esters of organic acids were separated in columns packed with 10% polyethylene glycol 6000 or 10% Peoplex 400 on Chromosorb W solid phase using a flame ionization detector. The results indicate the presence of fluoroacetate and fluorocitrate in forage crops collected near the phosphate plant. This suggests that atmospheric fluoride may be incorporated by plants into the organic form with the formation of toxic fluoroacetic and fluorocitric acids.

3058 APTIC NUMBER 21459

Zweibaum, Frederic and James Moorhead
A MULTI-ELEMENT ATOMIC ABSORPTION ANALYZER. Atomic Absorption Newsletter, 6(6):134, Nov.-Dec. 1967.

A multi-element atomic absorption analyzer can determine four selected elements simultaneously while retaining the accuracy and sensitivity of the single-element form. This system was primarily designed for the continuous monitoring of several elements concentrated from the atmosphere into a small volume air stream. The air stream with enriched sample content is fed directly and continuously into the burner nebulizer. A block diagram of the system is presented. The four individual element lamps are grouped into pairs, and each pair uses the dual beam path of the instrument simultaneously. A 20 cps chopper chops the light from the hollow cathode lamps. The light from each pair of lamps is then reflected by a flat mirror through a lens onto a 1200 cps, multi-blade chopper. Every blade is a mirror on both sides. Light reflected to one toroid from one pair of lamps forms the reference beam, while the light transmitted from a second toroid forms the sample beam. The reverse is true for the other lamp pair, resulting in four double-beam systems 45 deg out of phase with each other. The beams are recombined with a beam splitter, which consists of a quartz plate onto which aluminum dots are evaporated covering half of the surface. There are two photomultipliers, ahead of which are pairs of exit slits which pass the two wavelengths for the elements being determined. Toxic elements, such as lead and beryllium at industrial facilities can be monitored with this system, and it has been successfully tested with bismuth, nickel, lithium 6 and 7.

3059 APTIC NUMBER 21402

Alkire, H. L.
AIR POLLUTION IN DORCHESTER COUNTY MARYLAND. Maryland State Department of Health, Baltimore, Div. of Air Quality Control, 26p., Jan. 1970. 16 refs.

The results are given of a survey of air pollution in Dorchester County, Md., one of the state's Eastern Shore counties, together with a general description of the county and its meteorology. Findings are on the basis of personal interviews, a review of complaint files, and some measurements of particulates and sulfur dioxide. The food processing and manufacturing plants of the area, which form its basic economy, cause most pollution problems. Some of the food processing pollutions are seasonal in late summer and early fall, and are well scattered, generally in rural sections. Most of these operations are conducted with oil-fired boilers. The seafood pollutions generally are limited to the western and southern sections of the county where population centers are very small and where better ventilation conditions occur than in interior sections. Due to the sparse population and the lack of significant industrial areas in other portions of the county, air pollution problems now and in the forseeable future likely will be minor, except for neighborhood nuisances. One of the recommendations made for the future is the shifting of refuse disposal from open-burning dumps to sanitary landfills.

3060 APTIC NUMBER 21403

Alkire, H. L.
AIR POLLUTION IN QUEEN ANNE'S COUNTY MARYLAND. Maryland State Department of Health, Baltimore, Div. of Air Quality Control, 20p., Jan 1970. 16 refs.

The results are given of a survey of air pollution in Queen Anne's Co., Md., located on the edge of the Washington-Boston megalopolis, together with a general description of the county and recommendations for the future. Findings are on the basis of interviews and a review of complaint files. Due to the sparse population and lack of any significant urban or industrial areas, air pollution problems now are minor and are expected to remain so in the forseeable future. Six small refuse dumps exist at which uncontrolled open burning in trenches occurs. It is recommended that refuse disposal be shifted to sanitary landfills. Industrial-type pollution is largely seasonal and is due to the processing of agricultural crops, the shelling and drying of corn, and the processing of oysters and clams. Some open burning of refuse by commercial interests exists. Although these are scattered small operations, they create nuisances in local areas. Topography, transportation, fuel use, meteorology, wind rose measurements, and air pollution measurements are presented. It is likely that suspended particulates average about 50 to 60 micrograms/cu m on an annual basis. Some areas in the immediate vicinity of the industrial operations probably average from 70 to 90 micrograms. However, on some occasions, daily measurements of 100-125 micrograms/cu m are measured. Dustfall would be less than 10 tons/sq mi/mo annual average. Sulfur dioxide should be less than 0.22 ppm during all months.

3061 APTIC NUMBER 21214

Altshuller, Aubrey P.
RELATIONSHIPS AMONG POLLUTANTS UNDERGOING ATMOSPHERIC REACTIONS IN CAMP CITIES IN THE U. S. Preprint, Air Pollution Control Associatio New York City, 56p., 1970. 22 refs. (Presented at the Air Pollution Control Association Annual Meeting 63rd, St. Louis, Mo., June 14-18, Paper 70-113.)

Relationships between nitric oxide and nitrogen dioxide, nitrogen oxides and oxidants, nonmethane hydrocarbons and oxidants, and sulfur dioxide and oxidants are considered from NAPCA measurements reported by the continuous air monitoring program (CAMP). High nitric oxide levels (0.33 ppm to 1.87 ppm) are associated with relatively low nitrogen dioxide levels (less than 0.25 ppm) at the CAMP stations in central city locations. The ratio of nitric oxide to nitrogen dioxide increases with increasing nitric oxide concentration, so that at 1 ppm of nitric oxide or above, the ratios average near to 10 to 1. When the oxidant level is elevated (0.10 ppm and above), ratios of nitric oxide to nitrogen dioxide range from 2 to 1 to 1 to 1. On these days with higher conversions of nitric oxide to nitrogen dioxide, the concentrations of these two substances are usually low. In Philadelphia, a significant fraction of days with elevated oxidant can be associated with concurrent 8-hour average sulfur dioxide levels below 0.05 ppm, but almost as many days of equally high oxidant level occur when the average sulfur dioxide level is at or above 0.20 ppm. Oxidant levels decrease with decrease in nonmethane hydrocarbon concentration. A significant fraction of days with elevated oxidant levels occur in Washington and Philadelphia when nonmethane hydrocarbon levels are in the 0.25 to 0.5 carbon ppm range during traffic peaks. To insure oxidant levels below 0.10 ppm, it appears necessary that nonmethane hydrocarbon levels be at or below 0.25 carbon ppm. Oxidant levels do not decrease consistently with decreasing nitrogen oxide levels within the range recorded at CAMP monitoring locations; an appreciable fraction of the total hours of elevated oxidant levels occurs on days when concentrations of nitrogen oxides are 0.05 ppm or lower during traffic peaks. Concurrent reduction of both nitrogen oxides and nonmethane hydrocarbons at various ratios of these reactants does not appear to result in as rapid a reduction of oxidant as does reduction of only the nonmethane hydrocarbon concentrations. Elevated oxidant levels (0.10 ppm and above) occur on the average on 40 days and 160 hours/year at all CAMP locations except Chicago; elevated nitrogen dioxide levels (0.25 ppm and above) occur less than 1 hour/year on the average at CAMP locations except in Denver, where the average is about 3 hours a year. (Auth abstract modified)

3062 APTIC NUMBER 21462

Aschoff, Alroy P.
CONSIDERATIONS IN DESIGN OF AIR MONITORING NETWORK. Proc. Am. Soc. Civil Engrs., J. Power Div., 95(PO1):119-130, March 1969. 17 refs. (Presented at the ASCE Natl. Meet. on Environ. Eng., Chattanooga,

Tenn., May 13-17, 1968.)

The design of an air monitoring network for a power plant installation requires a definition of what contaminants require sampling; the main items of concern would include sulfur dioxide and particulates, especially for coal and oil fired units, as well as oxides of nitrogen and sulfur trioxide. The number and location of sampling stations must be determined, based on such factors as meteorology, population density, prevailing winds, location of nearby agricultural or botanical enterprises, features of the physical environment, and location of other emitters. Diffusion calculations are a useful guide in establishing station perimeters. Sampling stations may be either portable or permanent or a combination of the two; the advantages and disadvantages of each are given. Factors in station design are briefly noted, and choice of instrumentation, particularly for sulfur dioxide and particulate sampling and analysis, is reviewed. Data handling techniques, capital and labor costs are additional considerations. Capital cost for a typical program is itemized and totals an estimated $53,000-73,000, requiring about 35 man-days per month for all the preparation, analysis, service, maintenance, and data retrieval operations involved. Possible future legal proceedings should also be kept in mind in planning the monitoring program.

3063 APTIC NUMBER 20911

Bouquiaux, J. and J. Grandjean
ATMOSPHERIC POLLUTION. SMOKE AND SO2. (Pollution atmospherique. Fumee et SO2). Text in French. Bull. Mens. Inst. Royal Meteorol. Belgique., Oct. 1968. 22p.
CFSTI· N69-33875

The Belgian surveillance network for atmospheric pollution was created on initiative of the General Administration for Hygiene of the Ministry of Public and Family Health. The pollution indices chosen were the strong acidity of the air, expressed in micrograms of sulfur dioxide per cu m of air, and the smoke, or fine dust, expressed in micrograms per cu m of air. The sampling apparatus (shown schematically and in a photograph) consists of an electric membrane sucking about 2 cu m of air per day across a filter made of Whatman paper No. 1, a bubbling bottle containing 50 ml of oxygenated water (with 0.3% of H2O2) having a pH of 4.5, and a gas meter. The complete apparatus contains 8 filter-bubbling bottle circuits commuted automatically every morning; thus, the samples are removed only once a week. Reflectometric analysis of the filter paper and acidimetric titration of the liquid in the bubbling bottle yield the mean contents of smoke and SO2 per cu m of air during the 24 hours in which the samples are taken. The surveillance network comprises 230 sampling stations distributed as follows: 100 in the 5 large high-density regions of the country; Brussels (25), Antwerp (25), Liege (20), Charleroi (15), Ghent (15); 100 in less important towns and at selected locations in the country, and 30 at meteorological stations equipped with anemometers. The data for October 1968 are given in tables and plotted in graphs.

3064 APTIC NUMBER 20933

Bouquiaux, J. and J. Grandjean
ATMOSPHERIC POLLUTION: SMOKE AND SO2. (Pollution atmospherique: fumee et SO2). Text in French. Bull. Mens. Inst. Royal Meteorol. Belgique, 22p., Dec. 1968.
CFSTI: N69-37395

This monthly report of results of air-pollution surveillance in Belgium lists the daily sulfur dioxide content, in microgram/cu m of air; the daily smoke or fine dust content, in microgram/cu m of air; and the ratio: smoke content/SO2 content at the sites of 230 sampling stations distributed as follows: in Brussels (25), in Antwerp (25), in Liege (20), in Charleroi (15), in Ghent (15), in smaller towns and at selected points in the country (100), and at meteorological stations equipped with anemometers (30). A sampling unit consists of an electrically powered diaphragm pump continuously sucking approximately 2 cu m of ambient air per day through a filter with Whatman paper No. 1, a bubbling tank containing 50 ml of water oxygenated (with 0.3% H2O2) which has a pH of 4.5, and a gas meter. Each sampling station contains 8 such units; the daily samples are removed for testing once a week only. The smoke and fine dust trapped by the filter are determined reflectometrically and the SO2 trapped by the bubble tank, by acidimetric filtration. Samples collected at the 75 stations in the four cities other than Brussels are analyzed by laboratories located in these cities; all others are analyzed by the Laboratory of Chemistry and Physics of the Institut d'Hygiene et d'Epidemologie, Brussels.

3065 APTIC NUMBER 21064

Bouquiaux, J., and J. Grandjean
ATMOSPHERIC POLLUTION: SMOKE AND SO2. (Pollution atmospherique: fumee et SO2). Text in French. Bull. Mens. Inst. Royal Meteorol Belgique, 22p., Nov. 1968.
CFSTI: N69-37393

This monthly report of results of air-pollution surveillance in Belgium lists the daily sulfur dioxide content, in micrograms/cu m of air; the daily smoke or fine dust content, in micrograms/cu m of air; and the ratio: smoke content/SO2 content at the sites of 230 sampling stations distributed as follows: in Brussels (25), in Antwerp (25), in Liege (20), in Charleroi (15), in Ghent (15), in smaller towns and at selected points in the country (100), and at meteorological stations equipped with anemometers (30). A sampling unit consists of an electrically powered diaphragm pump continuously sucking approximately 2 cu m of ambient air per day through a filter with Whatman paper No. 1, a bubbling tank containing 50 ml of water oxygenated (with 0.3% H2O2) which has a pH of 4.5, and a gas meter. Each sampling station contains 8 such units; the daily samples are removed for testing once a week only. The smoke and fine dust trapped by the filter are determined reflectometrically and the SO2 trapped by the bubble tank - by acidimetric titration. Samples collected at the 75 stations in the four cities other than Brussels are analyzed by laboratories located in these cities; all others are analyzed by the Laboratory of Chemistry and Physics of the Institut d'Hygiene et d'Epidemologie, in Brussels.

3066 APTIC NUMBER 20455

Bourelly, T.
ATMOSPHERIC POLLUTION IN THE REGION OF PARIS: CAMPAGNE 1967-1968. (La pollution atmospherique dans la region Parisienne: Campagne 1967-1968). Text in French. Cahiers Centre Sci. Tech. Batiment, 96(834):1-12, Jan./Feb. 1969.

Variations in pollution, week-by-week and over working days and non-working days, were analysed as a function of wind-speed in Campagne, France; levels of highly acidic pollution were compared with those of black-smoke pollution. Meteorological phenomena common to those days on which pollution exceeds 100 micrograms/cu m were plotted. A compass-card was drawn up by wind frequency corresponding to the dates of maxima one-day pollution levels exceeding this figure for three different localitities situated to the N.E., S.W., and W.N.W. of Paris. These cards show a sector where the frequency is high, and two main arms which are approximately on the Paris axis. The monthly maxima for daily pollution corresponds statistically with days on which the measuring point was struck by winds from the direction of Paris. (Author abstract modified)

3067 APTIC NUMBER 21065

Dudey, W. D., L. P. Moss, and V. P. Moshkin
APPLICATION OF ACTIVATION ANALYSIS AND GE(LI) DETECTION TECHNIQUES FOR THE DETERMINATION OF STABLE ELEMENTS IN MARINE AEROSOLS. In: Modern Trends in Activation Analysis. James R. DeVoe (ed.), vol. 1, Washington, D. C., Dept. Commerce, NBS SP312, June 1969. 6 refs.

The concentrations of 20 trace elements in marine aerosols are reported. The determinations were made possible by the application of a lithium-drifted germanium detector and by neutron activation analysis techniques after the development of a separation scheme to remove sodium from the over-ocean samples. Each nuclide was identified on the basis of the energy of the gamma ray, the half life, the presence of associated gamma rays with the proper relative intensities, and the presence of the nuclides on the appropriate ion exchange resin. The pertinent cross sections and decay characteristics of each nuclide are listed. A comparison of some rare earth ratios found in the aerosols to ratios reported for soil, shale, and chondritic meteorites suggests a soil type origin for the rare earths in over-ocean aerosols. Presumably, aeolian transport is an important mechanism for the input of many trace elements to the ocean. Several elements identified are of considerable geochemical and public health interest; zinc, cadmium, mercury, and selenium, for example, were present in amounts which are respectable percentages of their concentrations in the presumably contaminated air of several coastal cities. It is pointed out that the sensitivity of the analyses were determined primarily by filter blank concentrations and secondarily by the relative intensities of the gamma rays in each spectrum. The accuracy could be significantly improved by measurements relative to a standard solution of composition similar to the samples.

3068 APTIC NUMBER 21680

Egorov, V. V., T. N. Zhigalovskaya, and S. G. Malakhov
MICROELEMENT CONTENT OF SURFACE AIR ABOVE THE CONTINENT AND THE OCEAN. J. Geophys. Res., 75(18):3650-3656, June 20, 1970. 8 refs.

The spectrum analysis method of determining the metal content in aerosol samples deposited on a cathode is described. The concentrations of 11 metals in air over locations within the USSR and in maritime regions were measured. Sensitivity of the method is 0.00001 microgram/cu meter. Trace element concentrations are higher in central regions than in coastal regions by an order of magnitude; the lowest levels are observed in polar regions. Among meteorological factors, vertical turbulent mixing in the lower troposphere and precipitation can have a significant influence on time variations in the trace element concentration of surface air. Tables of trace element concentration, location, and monthly variation are included. (Author abstract modified)

3069 APTIC NUMBER 21015

Hasegawa, T. and A. Sugimae
TRACE METALS IN SUSPENDED PARTICULATES IN OSAKA PREFECTURE. PART I. (Osaka ni okeru fuyufunjinchu no kinzokuseibun (1). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):143, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Suspended dust particles in air from several locations in the Osaka area were studied over a six-month period with particular emphasis on metal elements in the particles. The dusts were collected for 24 hrs by high-volume air samplers, and were accumulated on glass fiber filters. Without prior treatment, the particles were quantitatively analyzed for metallic elements by means of spectroscopy, which was a much more direct and easier method to use than the time-consuming WASN method. In heavy oil combustion, vanadium was found in a much larger quantity than other metals, and iron and manganese proliferated around the cupola furnaces. Lead was extracted from auto exhausts. The correlation between sulfur compounds and vanadium in heavy oil combustion gas was good but on rainy days, the linear relationship went askew, apparently because rain decreases the concentration of sulfur oxides in air. Relationships between various metals were investigated in connection with location, daily variations, and meteorological factors.

3070 APTIC NUMBER 20301

Iki, S. and S. Yoshinaga
HEAVY METALS IN THE ATMOSPHERIC DEPOSIT IN KITA-KYUSHU CITY. (Kita-Kyushushi ni okeru kokabaijinchu no jukinzokuseibun ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 4(1):108, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Iron and steel works and other metal industries from the industrial core of Kita-Kyushu. Measurements of industrial fallouts were recorded at 30 locations in the city, with 10 locations assigned to each of the industrial, commercial, and residential sectors during the months of February, October, and December of 1968. The samples were tested by means of deposit gauge, colorimetric analysis, and atomic absorption methods. The atmospheric dust particles of the city contain many heavy metallic substances and compounds, in addition to the ash from the combustion of coal and heavy oil. The metallic substances originate from the metal industries. The metallic composition of the dust particles do not differ significantly at separate locations, probably because the industries are so widely dispersed throughout the city. The water quality of the area is not much polluted by these heavy metallic substances, since they are mostly contained in insoluble matter instead of soluble matter. However, their effect on the quality of the soil and hence to the agricultural products, and their influence on commercial fishery due to the efflux into the open sea, is yet to be investigated.

3071 APTIC NUMBER 20642

Just, J., S. Maziarka, and H. Wyszynska
SANITARY EVALUATION OF DUST CONTAIN IN AMBIENT AIR OF SOME CITIES IN POLAND. (Sanitarna charakterystyka i ocena zapylenia powietrza atmosferycznego niektorych miast w Polsce). Text in Polish. Gaz, Woda Tech. Sanit. (Warsaw), 44(3):96-100, 1970. 23 refs.

Samples of atmospheric aerosols were systematically collected in ten towns. The contents of dust, tar, some polycyclic aromatic hydrocarbons, lead, and beryllium were determined. The level of atmospheric pollution was evaluated on the basis of existing standards and toxicological literature. High contents of particulate matter in the air were found in all the towns studied; the highest levels were found in Zabrze, Katowice, and Krakow. In several towns, the level of airborne carcinogenic hydrocarbons was also very high. It is believed that the metal content would cause no harmful effects.

3072 APTIC NUMBER 21352

Katz, M. and J. L. Monkman
THE ORGANIC FRACTION OF PARTICULATE POLLUTION INCLUDING POLYCYCLIC HYDROCARBONS. Occupational Health Rev., 16(1):3-16, 1964. 38 refs.

Considerable variations are found in the periodic averages of soluble organic matter extracted from particulates of the urban atmosphere. Tabulated monthly averages are presented for particulate matter and solvent extraction analysis of air samples for a number of American cities and Ottawa. Various studies on the relationship between carcinogenesis and the concentration of certain polycyclic hydrocarbons in polluted air are reviewed. Seasonal variation in content of organic material in urban atmosphere showed the anticipated high-winter low-summer trend. Smoke and soot from fuel-burning equipment, particularly solid fuel, are a much more prolific source of aromatic polycyclic hydrocarbons than liquid or gaseous fuels, or exhaust gases from efficiently operated diesel or gasoline motor vehicles. Problems in analysis of polycyclic hydrocarbons are summarized and current sampling procedures are discussed. Theories dealing with the carcinogenic activity of polycyclic hydrocarbons are reviewed. It is felt that there is a need for a more complete classification of aromatics and other hydrocarbons, phenols, quinones, nitrogen derivatives and other organics that are present as atmospheric contaminants. Moreover, new and quicker methods of biological appraisal of potentially cancerous air pollutants are long overdue.

3073 APTIC NUMBER 20343

Kawai, S., Y. Takada, Y. Takenobu, and T. Tada
MEASUREMENT OF PARTICULATE MATTER BY HIGH VOLUME AIR SAMPLER. (High volume air sampler ni yoru fuyufunjin no sokutei ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):30, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

From 1967 to 1969, periodic high volume air samplings were conducted on top of the Kyoto Institute of Public Health building as well as the South Fire Station (industrial area). The results were compared with those obtained from the filter paper sampling and digital samplings, as well as the target values set within the Air Pollution Control Policy of the Welfare Ministry. In addition, the effects of dusts being swept up from the ground were observed, since their significance cannot be ignored, although the main constitutents of the suspended particles originate from combustion of fuel. Among the various components, tar(benzene soluble materials), which is closely related to combustion but has no relation to dust particles, was chosen as an index. If its concentration and the concentration of suspended particles can be fit into a linear regression, then the intercept term would correspond to the concentration of such particles as dust. The conclusion drawn from the statistically significant results of the analysis was that particles such as dust occupy about one-half at the Institute of Public Health and one-third at the South Fire Station out of the total concentration of the suspended particles in the atmosphere.

3074 APTIC NUMBER 21120

Kelley, John J., Jr.
OBSERVATIONS OF CARBON DIOXIDE IN THE ATMOSPHERE OVER THE WESTERN UNITED STATES. J. Geophys. Res., 74(6):1688-1693, March 15, 1969. 8 refs. Also: Washington Univ., Seattle, Dept. of Atmospheric Sciences, Contract N00014-67-A-0103-0007, NR 304 252, TR 2.
CFSTI: AD 690404

Carbon dioxide in the atmosphere was investigated by continuous infrared analysis from an aircraft over the western United States. The average concentrations of CO2 for all legs of the flight transect was 323 ppm by volume dry air. The CO2 concentration diminished by 2.2 ppm from the west coast to north-central Colorado. This vertical carbon dioxide gradient may possibly be a result of CO2 sources in west coast industrial and urban areas. The continuous analysis of CO2 in the atmosphere by means of a

nondispersive infrared analyzer offers a convenient method for monitoring CO2 over long distances. This method tends to average out variations in CO2 due to local sources.

3075 APTIC NUMBER 20373

Kharakhinov, M. K.
MOSCOW ATMOSPHERIC AIR POLLUTION DURING 1948-1958. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:180-184, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

Results of air quality measurements in Moscow from 1948 to 1958 show a gradual reduction in dust concentration; this is attributed to a city ordinance requiring use of both low ash- and sulfur-content coal in the city's industrial plants and efficient ash and dust collecting devices. Sulfur dioxide concentrations also show a slow reduction, principally as a result of an increasing substitution of nautral gas for coal as a fuel. In 1957, gas consumption increased by 50% compared with the previous year. Soot content remained high, despite a decrease in the number of samples exceeding allowable concentration limits.

3076 APTIC NUMBER 20342

Kohgo, T., T. Oyake, and R. Endo
AIR POLLUTION OF SAPPORO IN HEATING-SEASON. PART III. RELATION BETWEEN THE PARTICULATE AND THE OTHER POLLUTANTS. (Sapporoshi no fuyu no taiki osen (3): kakushu osen busshitsu no sokankankei ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):29, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The relationship between suspended dust particles and sulfur dioxide was studied based on the data obtained in Sapporo in the winter of 1968-69. Since most of the pollution there is due to heating, and tape sampler as well as digital counter methods were used for the particulates and an automatic measurement device was used for sulfur dioxide. The results of P-rosaniline method showed that sulfur dioxide is highly concentrated in the central area of the city and tapers off outwards. Various numerical results from the different methods are tabulated. In terms of the correlation between various pollutants, the correlation between the digital sampler and tape sampler data was the highest (0.86-0.91). The correlation between the tape sampler and sulfur dioxide measurements was similar to the correlation between the digital sampler and sulfur dioxide measurements. The various regression lines are diagrammatically represented.

3077 APTIC NUMBER 20268

Konno, K.
CONCENTRATION OF AIR CONTAMINATION IN OUTDOOR AND INDOOR. (Tatemono naigai no kukiosendo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):142, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The concentration of air contamination is discussed with special reference to sulfur dioxide and dust particles. Diagrammatic and numerical results of the air pollution measurement both in- and outdoors, with or without air-cleaning filters are presented. The data were gathered at a building in central Tokyo. When air conditioning is in operation, the outdoor pollution penetrates indoors through the mechanical ventilation system as well as the natural ventilation of opening and closing doors. Mathematical formulae are developed whereby under either under the existence of air conditioning or static conditions, the concentration of pollution indoors after time t can be calculated from variables such as outdoor pollution concentration, initial indoor concentration, concentration at t equals infinity, volume of air intake, rate of natural ventilation, rate of particle filtration, etc. By initially fixing the desired indoor concentration and giving the observed values to the other variables, the rate of particle fil ration, and hence the desired type of filter, can be computed.

3078 APTIC NUMBER 20649

Konoe, A., T. Kanmori, K. Seki, and Y. Takahashi
MEASUREMENT OF ATMOSPHERIC CONCENTRATION OF SULFUR OXIDES AND NITROGEN OXIDES BY FILTER PAPER IMPREGNATED WITH ALKALI IN KONOHANA, OSAKA CITY. (Osaka-shi Konohana-ku ni okeru arukari roshiho ni yoru iwosankabutsu oyobi chissosankabutsu nodo bunpu ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):8, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The Konohana district of Osaka, an area elongated in the east-west direction, was divided into grids in the range of 400 to 800 meters; sulfur trioxide as well as nitrogen dioxide in air were measured by alkali filter paper, for the period between the fifth of each month. The results were tabulated in milligrams per day 100 sq cm by location (grid number) and maximum, minimum, and average values. The sulfur trioxide concentration in the western industrial section was high and low in the eastern residential section, and high along the waterfront and low in the interior, with localized high concentrations. Thus, most of the pollution sources are considered to exist within the Konohana area with respect to the sulfur trioxide pollution.

3079 APTIC NUMBER 21121

Kopczynski, S. L., W. A. Lonneman, F. D. Sutterfield, and P. E. Darley
PHOTOCHEMICAL REACTIVITY OF THE LOS ANGELES ATMOSPHERE. Preprint, Public Health Service, Cincinnati, Ohio, National Air Pollution Control Administration, 26p., 1969. 7 refs. (Presented at the Air Pollution Control Association Annual Meeting, 62nd, New York, June 22-26, 1969.)

During the fall of 1968, samples of downtown Los Angeles air were collected in large plastic bags and irradiated with natural

sunlight. The samples were analyzed periodically before and during irradiation for C1 to C10 hydrocarbons, nitric oxide, nitrogen dioxide, peroxyacetylnitrate, total oxidant, and carbon monoxide. The reaction curves for the irradiated samples were similar to those reported for synthetic laboratory mixtures of hydrocarbons plus NOx in air. The irradiated samples were characterized by significant reaction of olefins, aromatics, and most of the paraffins; conversion of nitric oxide to nitrogen dioxide; and formation of oxidant and peroxyacetylnitrate. Reaction rates of various hydrocarbons in the complex atmospheric mixtures were in agreement with those reported for laboratory studies. Atmospheric samples producing the highest oxidant concentrations, highest losses of olefins plus aromatics, and highest NO2 formation rates were associated with both high hydrocarbon and high NOx concentrations. The reactivity measure which showed the best overall correlations with initial reactant concentrations and other reactivity measures was the quantity of olefins plus aromatics reacted. A reduction of light intensity shifts the reaction curve to the right, but effects on products yields varied over a considerable range. It was found that times to the NO2 peak and times to half the oxidant peak were inversely proportional to the light intensity. All paraffins except isobutane and those of lower molecular weight reacted in atmospheric samples. There was considerable overlap of percentage consumption of paraffins and aromatics. As a class, the paraffins showed one fifth the average reactivity of the olefins, and the aromatics one half. The aromatics accounted for the greatest yields of reacted carbon atom in the atmospheric samples irradiated for 4 hours at full sunlight intensity.

3080 APTIC NUMBER 20508

Kozlova, M. V., I. P. Korenkov, Yu V. Novikov, and D. D. Granovskaya
THE STUDY OF THE CONCENTRATIONS OF LONG-DURATION RADIOACTIVE AEROSOLS OF ATMOSPHERIC AIR IN ITS RELATION TO THE AMOUNT OF DUST. Moscow Municipal Epidemic Hospital (USSR) and Erisman Research Inst. of Hygiene, Moscow (USSR). 4 refs. Translated from Russian. Army Foreign Science and Technology Center, Washington, D. C., 5p., Sept. 18, 1969.
CFSTI, DDC: AD 695177

In 1965, 78 samples of atmospheric air in Moscow were collected at a height of 15 meters over soil covered with asphalt and analyzed for radioactivity and stable dust. During the year, concentrations of surface-layer dust ranged from 0.03-0.7 mg/cu m. Concentrations of Beta-active long-duration aerosols were from 1-9 times 10 to the minus 17th power curie per l. A direct relationship existed on some days between the concentrations of the Beta-active aerosols and the amount of dust in the air. As established by correlation analysis, the coefficient of the correlation between the aerosols and the dust was plus 0.4 plus or minus 0.08. The coefficient, though not close to unity, does point to an existing mutual relationship.

3081 APTIC NUMBER 20519

Kutscher, Waldemar and Rene Tomingas
INVESTIGATIONS OF ATMOSPHERIC DUST COLLECTED IN MANNHEIM FROM 1965 TO 1967 WITH SPECIAL EMPHASIS ON BENZOPYRENE CONTENT. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(1):21-25, Jan. 1969. 3 refs.

The results of dust measurements in the city of Mannheim, Germany, made for the three-year period 1965-1967, are reported. The dust was collected from a filter installation supplying fresh air to a high-rise office building at a height of 49 m. The air first passed a primary mat filter, which retained the coarser dust particles, and subsequently through a secondary electrostatic precipitator where the fine component was separated. The ash and carbon content of dust remained almost constant during this period. A considerable disparity was observed between the monthly values for dust content; in contrast to this, previous observations that the benzopyrene content of air depends on seasonal variations, reaching a maximum in winter months and a minimum in summer were confirmed. No relationship was found between weather conditions and degree of air pollution by dust. (Author summary modified)

3082 APTIC NUMBER 21285

Lahmann, Erdwin
OZONE IN CITY AIR. (Ozon in staedtischer Luft). Text in German. Umschau (Berlin), 69(21):693-694, 1969. 3 refs.

In a busy street in Berlin Steglitz, continuous measurements of the atmospheric ozone content were taken over a period of one year. Simultaneously, measurements of the ozone content were taken in a traffic-free area 2 km away. The air over the busy street contained a maximum of 0.05 ppm ozone. The average ozone concentrations measured during the period were lower, the closer the sample was taken to the street. The diurnal variations at the two measuring sites indicate a decrease of the ozone content of the air due to automobile exhausts. At traffic peaks, the ozone concentrations were much lower than in traffic-free areas. The chemical reactions between ozone and the unsaturated hydrocarbons decreased the ozone content of the air above the street quite markely. No photochemical formation of ozone was observed, however.

3083 APTIC NUMBER 20761

LaHue, Miles D., John F. Pate, and James P. Lodge, Jr.
ATMOSPHERIC NITROUS OXIDE CONCENTRATIONS IN THE HUMID TROPICS. J. Geophys. Res., 75(15):2922-2926, May 20, 1970. 5 refs.

Nitrous oxide concentrations were obtained from the atmosphere in and above the forests of Panama. Samples were also collected from the coasts of Panama and Barbados for comparison of N2O levels in Caribbean air with those in Atlantic air. The system used to collect and analyze the samples consisted of three straight polyyethylene drying tubes, a molecular sieve, a 10 ml transfer loop, and determination by gas chromatography. All valid data was closely grouped around a figure nr 260 ppb. Data for the Atlantic side of the Isthmus during the dry season,

208 ppb N2O, and for ground level at Albrook, 184 ppb N2O, were clearly outside this range. It is not clear whether these values reflect systematic differences, local anomalies, or are a statistical accident. These values found for the tropics are similar to those reported for the temperate ozone, namely 190 to 290 ppb N2O.

3084 APTIC NUMBER 20947

Lampadius, F.
AIR ANALYSES FOR DETERMINATION OF THE FILTRATION OF SULFUR DIOXIDE BY FOREST STANDS. (Rozbory vzduchu k zjisteni filtrace SO2 lesnimi porosty). Scientific and Technical Society, Prague (Czechoslovakia), Agriculture and Forestry Section, Proc. Conf. Effect Ind. Emission Forestry, Janske Lazne, Czechoslovakia, 1966, p. XIV-1 to XIV-4. (Oct. 11-14.) Translated from Czech. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, April 24, 1969.

The theory of filtration capacity, based on the capability of forests to filter air and smoke damage by means of air analysis, was investigated. The investigation was based on the 'pararosaniline' method using the measuring box (Messkoffer) which is sensitive to the presence of sulfur dioxide in the air. It permits evidence of short-term, very slight variations in sulfur dioxide concentrations by means of short-term sampling of the duration of eight to 10 minutes. The methodology aims at comparing the measurements for an unforested area in front of the forest with results in the interior of the forest obtained at various distances from the smoke emission source in the direction of the wind. The meteorological factors such as direction and velocity of winds, temperature, relative humidity of air, visibility, and cloudiness were taken into consideration. The results obtained show that the sulfur dioxide content inside the forest, and comparatively far from the smoke emission sources, fluctuate greatly. The distribution of these fluctuations over a period of time arise both convectively and advectively; they are often periodic. Assuming a retarded exchange in the above-ground layer of air, the air samples inside the forest showed from time to time higher concentrations of sulfur dioxide in comparison to the free terrain. It is concluded that the filtration capability, so far attributed to forests, does not correspond to the actual state of affairs to the extent so far assumed.

3085 APTIC NUMBER 20900

Lavtinenko, P. F.
CONTENT OF NITROGEN COMPOUNDS IN PRECIPITATION DURING THUNDERSTORMS. (O soderzhanii soyedineniy azota v osadkakh pri grozakh). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no. 234:205-207, 1968. 6 refs.

A method for determining the concentration of nitrogen trioxide and nitrogen dioxide in thunderstorm precipitation using dry powdered Greiss reagent is described. Studies revealed no correlation between ion concentration and frequency of electrical discharge, nor any significant increase in ion content in precipitation during electrical storms.

3086 APTIC NUMBER 20903

Lonneman, W. A., T. A. Bellar, and A. P. Altshuller
AROMATIC HYDROCARBONS IN THE ATMOSPHERE OF THE LOS ANGELES BASIN. Environ. Sci. Technol., 2(11):1017-1020, Nov., 1968. 20 refs.

Gas chromatographic analyses were obtained for six- to ten-carbon aromatic hydrocarbons in 126 samples collected in downtown Los Angeles and in 10 samples collected in Pasadena, Lennox, and West Los Angeles, making it possible to relate the levels of aromatic hydrocarbons to atmospheric photochemical reactivity. Concentrations averaged 0.106 parts per million, while toluene, the most abundant aromatic hydrocarbon, constituted 35 to 40% of the total concentration. The more reactive dialkyl- and trialkylbenzenes constituted 40% of the aromatics measured. Ratios of several aromatic hydrocarbons to each other were computed, indicating that large changes occurred at the individual sampling locations both within one day and among different days and conversely, that ratios remained within a relatively narrow range for periods of hours at the same and at different sampling locations at the downtown Los Angeles facility. Only the ratios of o-xylene plus p-xylene to m-xylene varied over a narrow range; 90% of the values range from 0.85 to 1.15, with an average value of 0.99. Toluene-to-benzene ratios were compared in atmospheric samples and in exhaust samples to test the contribution of solvent losses to total aromatics, and the over-all average was 1.8 to 1 for automobiles and 1.5:1 to 5.0:1 for atmospheric samples. No relationship of aromatic hydrocarbon content to methane could be found other than a tendency for higher concentrations of pollutants to occur generally with poorer ventilation. Ratios of hydrocarbon to nitrogen oxides were consistent with the observed oxidant concentrations. (Author abstract modified)

3087 APTIC NUMBER 21079

Loucks, Ronald N., John J. Winchester, Wayne R. Watson, and Mary A. Tiffany
THE HALOGEN COMPOSITION OF AEROSOL PARTICLES OVER LAKE MICHIGAN. In: Modern Trends in Activation Anaylsis. James R. DeVoe (ed.), vol. 1, Washington, D. C., National Bureau of Standards SP312, Dept. of Commerce, 1969, p. 36-42. 10 refs.

Results of the first intensive sampling of aerosols for halogens in the inland U. S. are presented in tables. Previously published analyses of aerosols for the halogen elements bromine, chlorine, and iodine were restricted to coastal locations where local sources of sea salts are present. The inland sampling was carried out with a cascade impactor and an Andersen sampler in the southern basin of Lake Michigan and in runs between Grand Haven and Chicago. Chemical analysis for halogens was done by neutron activation and anodic stripping. A large fraction of both iodine and bromine was found to be held by particles less than 0.25 micron radius, without apparent systematic differences due to location, winds, or relative humidity. However, total iodine concentrations did not vary with proximity to the Chicago-Gary area, implying that iodine has no significant pollution sources associated with urbanization. In contrast, the differences in

bromine values strongly suggest an urban pollution origin for such atmospheric bromine. Negligible amounts of chlorine were held by particles smaller than 0.25 micron radius, but a third of it was held by particles above 1 micron radius, without apparent correlation with meteorological parameters. A local industrial pollution source other than automobile or fuel combustion is suggested.

3088 APTIC NUMBER 20346

Lux, H.
EXPERIENCES OF AIR INVESTIGATION IN THE IMMISSION REGION OF POWER PLANTS IN THE FORST REGION (NEISSE, OBERLAUSITZ). (Ergebnisse von Luftuntersuchungen im Einlussbereich der Kraftwerke um Hirschfelede (Neisse, Oberlausitz). Text in German. Z. Hyg., 16(3):185-187, 1970. 7 refs.

Measurements of sulfur dioxide and flue-dust sedimentation were conducted over a two-year period and an 18-month period, respectively, in the forest region of Marienthal, which belongs to the emission area of three power stations. Mean 24-hr SO2 values were 0.08 to 0.10/mg cu m in the nonheating season and 0.21 mg/cu m in the heating season. When prevailing winds were south or southeast, concentrations invariably exceeded the allowable maximum of 0.15 mg/cu m by 22%, as compared to only 10% for all other wind directions combined. Forest damage due to SO2 exposure corresponded to the marginal zones of injury around Deutscheinsiedel (Erzgebirge). Apart from the aesthetic and economic damage caused by the SO2-induced destruction of trees, the recreational value of the land was reduced by the flue-ash sedimentation, which exceeded the maximum admissible values of 15 g/sq m/month by 75-100%.

3089 APTIC NUMBER 21215

Hasenbrook, M. J. and D. R. Purdy
CONCURRENT MEASUREMENTS OF WATER VAPOR AND OZONE OVER WASHINGTON, D. C., DURING 1967 AND 1968. Naval Research Lab., Washington, D. C. Atmospheric Physics Branch NRL Prob. A03-09, Proj. A37540/652/69-R004-02-01, NRL Rept. 6974, 176p., Nov. 4, 1969. 5 refs.
CPSTI, DDC: AD 699152

A program for the systematic observation of water vapor and ozone at heights to 100,000 feet was initiated in January 1967 to obtain concurrent distributions in the atmosphere of these two gases and provide data for studies of the atmosphere's general circulation. Balloon-borne soundings were made at approximately 1-month intervals from a site near Washington, D. C., at the NRL Chesapeake Bay Division (38.6 deg N and 76.6 deg W). The observational program through 1968 has provided 19 vertical profiles of water vapor and ozone in the atmosphere, which are presented here in tables and graphs. Water vapor measurements were obtained using a frost-point hygrometer, while the partial pressure of oxygen was measured by means of an electrochemical concentration cell using the oxidation of KI by ozone as the basic reaction. Large discrepancies in ozone amounts between ascent and descent flights may have been the result of excessively low sensor temperatures during descent. (Author introduction modified)

3090 APTIC NUMBER 21076

Milokostova, L. G. and K. A. Prokopenko
ROSTOV-ON-DON ATMOSPHERIC AIR POLLUTION WITH AUTO-TRAFFIC EXHAUST CARBON MONOXIDE. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:215-217, 1963. (B. S. Levine, ed.)
CPSTI: 63-11570

Air pollution from automobile exhaust gases was studied at four main highways at five observation points located where automobile traffic was heavy. Air samples were collected through the months of April-September during the hours from 8 a.m.-9 p.m. and through the months of October-November during the hours of 8 a.m.-5 p.m. Samples were collected into liter flasks by the salt solution-negative-pressure method for 1-2 minutes at 1.5 m above the ground. Three samples were collected at each point; one on the highway itself, one on the sidewalk, and one near trees or bushes. With the aid of a gas analyzer, 1280 samples were analyzed. The results clearly indicated that the city air basin was heavily polluted with carbon monoxide and concentrations ranged between 1.5-80.0 mg/cu m. Approximately 87.7% of the samples exceeded the maximum allowable concentration. Generally, the CO concentration varied proportionately with the number of passing automobiles and also with the terrain and meteorological conditions. Carbon monoxide concentations were higher in the summer and varied very little between the highway, sidewalk, and trees. Samples collected at the wider highways contained lower CO concentrations than did samples collected at narrower highways, probably due to more intensive air circulation and ventilation.

3091 APTIC NUMBER 21440

ENVIRONMENTAL CONCENTRATIONS OF SULFUR DIOXIDE:1967-68. (Iwo-sankabutsu no knakyonodo:1967-68.) Text in Japanese. 13p., 1969 (?).

The sulfur oxide concentrations measured at various locations throughout Japan by the electroconductivity method in 1967 and 1968 are listed by year, annual average (ppbm), and 99% value. The annual average ranged from 1.0 in Kamaishi, Iwate Prefecture to 10.0 in Kawasaki, Kanagawa Prefecture in 1967 and from 0.7 in Hachinohe, Aomori to 9.2 in Ichihara, Chiba in 1968.

3092 APTIC NUMBER 20261

Mrose, H.
THE NITROGEN DIOXIDE CONTENT OF AIR DEPENDING UPON TIME OF YEAR, TIME OF DAY, AND WEATHER AT THE METEOROLOGICAL OBSERVATORY WAHNSDORF BY DRESDEN. (Der Stickstoffdioxidgehalt der Luft in Abhaengigkeit von Jahreszeit, Tageseit und Wetter am Meteorologischen Observatorium Wahnsdorf bei Dresden). Text

in German. Z. Ges. Hyg. (Berlin), 16(3):191-195, 1970. 5 refs.

In 1967 and 1968, atmospheric nitrogen dioxide concentrations were measured every workday at 7 and 12 o'clock at a meteorological observatory north of Dresden. The results are compared with those obtained for Berlin and some American cities. The annual variation, which is similar to that of SO2, demonstrates maximum values in winter and minimum values in summer. Morning concentrations are higher than those at noon; the differences is greater in summer than in winter. Air transport from the city (S-SSE) shows higher concentrations than winds from other directions. Nitrate originating in NO2 is found in precipitation water. Though measured concentrations did not reach the maximum allowable limit (short-term) of 0.3 mg/cu m, NO2 is an indicator of man-made air pollution.

3093 APTIC NUMBER 20355

Murata, M., H. Hirobe, H. Shima, T. Kanasaru, T. Matsui, and K. Naka
AIR POLLUTION IN YOKKAICHI CITY. (Yokkaichi no taiki osen: gasujo osen busshitsu (ryukaiwo) ni tsuite.) Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):5, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The citizens of Yokkaichi have complained extensively about obnoxious odors. Organic sulfur compounds and hydrogen sulfide emitted or leaking out from the local petrochemical industry were suspected of being the main cause, and an investigation on hydrogen sulfide was conducted. The observations were made around the industrial locations of the city during the winter of 1968 - 1969. Instantaneous measurement by means of milli-pore filter method was mainly employed. The concentration of hydrogen sulfide in the air around Yokkaichi was below 20 ppb, the odor threshold for hydrogen sulfide. However, if the rotten egg odor did originate in hydrogen sulfide, there probably was an operational mistake or emission from the factories.

3094 APTIC NUMBER 20354

Nakano, K. and S. Fukuoka
STUDY FOR CARBON MONOXIDE VERTICAL DISTRIBUTION. (Issankatanso no suichoku bunpu ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):18, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

In order to gain information of the apparently widely distributed high-concentration carbon monoxide pollution in a metropolitan area such Tokyo with high automobile traffic density, the vertical distribution of carbon monoxide was measured at various relatively low altitudes at locations away from the streets which were considered to be the pollution source. In summer, the concentrations were low, with no uniform relationship between the altitude and the concentrations. In winter, the concentration differences due to the altitude differential were prominent during and about one hour preceding and following the temperature inversion between 2 and 30 meter altitudes.

3095 APTIC NUMBER 20348

Nakatsuji, N., G. Ueda, and K. Sakai
ATMOSPHERIC POLLUTION FROM HEATING BOILER OF BUILDING. (Biru dambo no taiki osen ni oyobosu eikyo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):19, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The characteristics of air pollution due to heating of buildings in Osaka were analyzed based on the distributions of sulfur oxides concentrations (lead dioxide method), the number of smoke emission sources, and amount of sulfur emissions. The observations were conducted in the summer and the winter of 1968. The density of air pollution was high in winter in the central area of the city where it is mainly commercial and residential. The cause is attributed to the boilers for the winter heating of the buildings in the area, as well as the pollutants from the coastal industrial areas, although it is not yet clear meteorologically how the industrial pollutants are transported to the center.

3096 APTIC NUMBER 20580

National Air Pollution Control Administration, Raleigh, N. C., Div. of Air Quality and Emission Data
DATA TABULATIONS AND SUMMARIES. CONTINUOUS AIR MONITORING PROJECTS. NATIONAL AIR SURVEILLANCE NETWORKS. CINCINNATI 1968. NAPCA Pub. APTD 69-16, 103p., Dec. 1969.

Data tabulations are presented consisting of hourly average concentrations of six gaseous pollutants (carbon monoxide, nitric oxide, nitrogen dioxide, sulfur dioxide, total hydrocarbons, and total oxidants), and two-hour measurements of soiling index levels in Cincinnati during 1968. A brief summary of monthly means and maximums and graphs of seasonal-diurnal patterns of gaseous pollutants at the Cincinnati station are included. Annual frequency distributions of the data pertaining to gases and soiling index are presented for all six CAMP stations (Chicago, Cincinnati, Philadelphia, Washington, D. C., St. Louis, and Denver.)

3097 APTIC NUMBER 20581

National Air Pollution Control Administration, Raleigh, N. C., Div. of Air Quality and Emission Data
DATA TABULATIONS AND SUMMARIES. CONTINUOUS AIR MONITORING PROJECTS. NATIONAL AIR SURVEILLANCE NETWORKS. ST. LOUIS 1968. NAPCA Pub. APTD 69-19, 103p., Dec. 1969.

Data tabulations are presented consisting of hourly average concentrations of six gaseous pollutants (carbon monoxide, nitric oxide, nitrogen dioxide, sulfur dioxide, total hydrocarbons, and total oxidants), and two-hour measurements of soiling index levels in St. Louis, Mo. during 1968. A brief summary of monthly means and maximums and graphs of seasonal-diurnal

patterns of gaseous pollutants at the St. Louis station are included. Annual frequency distributions of the data pertaining to gases and soiling index are presented for all six CAMP stations (Chicago, Cincinnati, Philadelphia, Washington D. C., St. Louis, and Denver).

3098 APTIC NUMBER 20582

National Air Pollution Control Administration, Raleigh, N. C., Div. of Air Quality and Emission Data
DATA TABULATIONS AND SUMMARIES. CONTINUOUS AIR MONITORING PROJECTS. NATIONAL AIR SURVEILLANCE NETWORKS. PHILADELPHIA 1968. NAPCA Pub. APTD 69-18, 103p., Dec. 1969.

Data tabulations are presented consisting of hourly average concentrations of six gaseous pollutants (carbon monoxide, nitric oxide, nitrogen dioxide, sulfur dioxide, total hydrocarbons, and total oxidants), and two-hour measurements of soiling index levels in Philadelphia, Pa. during 1968. A brief summary of monthly means and maximums and graphs of seasonal-diurnal patterns of gaseous pollutants in Philadelphia are included. Annual frequency distributions of the data pertaining to gases and soiling index are presented for all six CAMP stations (Chicago, Cincinnati, Philadelphia, Washington, D. C., St. Louis, and Denver).

3099 APTIC NUMBER 20583

National Air Pollution Control Administration, Raleigh, N. C., Div. of Air Quality and Emission Data
DATA TABULATIONS AND SUMMARIES. CONTINUOUS AIR MONITORING PROJECTS. NATIONAL AIR SURVEILLANCE NETWORKS. DENVER 1968. NAPCA Pub. APTD 69-17, 103p., Dec. 1969.

Data tabulations are presented consisting of hourly average concentrations of six gaseous pollutants (carbon monoxide, nitric oxide, nitrogen dioxide, sulfur dioxide, total hydrocarbons, and total oxidants), and two-hour measurements of soiling index levels in Denver, Colo. during 1968. A brief summary of monthly means and maximums and graphs of seasonal-diurnal patterns of gaseous pollutants at the Denver station are included. Annual frequency distributions of the data pertaining to gases and soiling index are presented for all six CAMP stations (Chicago, Cincinnati, Philadelphia, Washington, D. C., St. Louis, and Denver).

3100 APTIC NUMBER 20974

DATA TABULATIONS AND SUMMARIES. CONTINUOUS AIR MONITORING PROJECTS. NATIONAL AIR SURVEILLANCE NETWORKS. WASHINGTON, D. C. 1968. NAPCA Pub. APTD 69-20, 103p., Dec. 1969.

One of the Continuous Air Monitoring Projects of the National Air Surveillance Networks is to routinely operate continuous monitoring stations in six major cities, including Washington. The data tabulations in this report consist of hourly average concentrations of six gaseous pollutants and 2-hr measurements of soiling index levels in Washington during 1968. The pollutants are carbon monoxide, nitric oxide, nitrogen dioxide, sulfur dioxide, total hydrocarbons, and total oxidants. A brief summary of their monthly means and maximums and graphs of their seasonal diurnal patterns are included. (Author abstract modified)

3101 APTIC NUMBER 21130

National Air Pollution Control Administration, Raleigh, N. C., Div. of Air Quality and Emission Data
1969 DATA TABULATIONS AND SUMMARIES. CONTINUOUS AIR MONITORING PROJECTS. NATIONAL AIR SURVEILLANCE NETWORKS. CHICAGO. NAPCA Pub. APTD 69-15, 103p., Dec. 1969.

One of the Continuous Air Monitoring Projects of the National Air Surveillance Networks is to routinely operate continuous monitoring stations in six major cities, including Chicago. The data tabulations in this report consist of hourly average concentrations of six gaseous pollutants and 2-hr measurements of soiling index levels in Chicago during 1968. The pollutants are carbon monoxide, nitric oxide, nitrogen dioxide, sulfur dioxide, total hydrocarbons, and total oxidants. A brief summary of monthly means and maximums and graphs of seasonal diurnal patterns of the pollutants are included. (Author abstract modified)

3102 APTIC NUMBER 20940

Nikolaev, S. P.
ATMOSPHERIC AIR DUSTINESS IN INHABITED SECTIONS OF AN INDUSTRIAL REGION. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:119-124, 1963. (M. S. Levine, ed.)
CFSTI: 63-11570

Atmospheric air dustiness was studied in two inhabited sections of an industrial region characterized by different methods of building construction. Air studies were conducted simultaneously at 2 points in each section. Air dust determinations were made by the aspiration method, the count method, the method of sedimentation on adhesive glass for the study of dispersion degree, and sedimentation in glass containers. Atmospheric air dustiness varied in inhabited section with the seasons of the year, being lower during summer months and rising with the heating season, which pointed to fuel as the basic origin of dust. Dustiness also varied during the day, reflecting the periodic operation of the region's industrial plants, and with the population's mode of living. Air dustiness manifested 2 maxima during the day: in the evening, between 7 and 10 o'clock and in the morning, between 7 and 9 o'clock. Minimum air dustiness was noted during the night hours. Dustiness in the fenced-in yards was considerably higher than in open yards accessible to ventilation. The average 24-hour dust concentration in living quarters exceeded the 0.15 mg/cu m limit of allowable dust concentration. Air dust in living quarters was characterized by a comparatively high degree of dispersion. Analyses showed that 97.5% of the dust consisted of particles less than 10 micron in diameter and only 2.5% of particles greater than 10 micron in diameter. The quantity of

dust settled from the air of living quarters located in the industrial regions generally exceeded the maximal averages in all other industrial sections of the city.

3103 APTIC NUMBER 20350

Odaira, T., M. Udagawa, and M. Funajima
THE RELATION OF THE SULFUROUS ACID GAS THAT IS CONTAMINATE HIGH DENSITY AT THE HIGH GROUND OF TOKYO TOWER TO THE PLANE MEASURING PLACES. (Tokyo tawa kosho no okeru aryusan gasu konodo osen to heimen sokuteiten to no kankei ni tsuite.). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):10, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Since Feb. 1969, sulfur dioxide and suspended particle measurements as well as the conventional meteorological data have continuously been recorded at various altitudess of the Tokyo tower, in addition to the observations at various ground surface locations in Tokyo. The relevance of the tower lies in the measurements of atmospheric pressure arrangements over a wide area, as well as the vertical structures of air temperature, wind direction, and velocity. Since the initiation of the observations, the concentrations of sulfur dioxide in air at various heights have been found to be very high under some meteorological conditions. The description of two days of sulfur dioxide pollution in May 1969 is given, together with the discrepancies between phenomena recorded at the ground surface level and on the tower.

3104 APTIC NUMBER 20524

Pady, S. M. and C. L. Kramer
DIURNAL PERIODICITY IN AIRBORNE BACTERIA. Mycologia, 59(4): 710-716, July/Aug. 1967. 3 refs.

To obtain information on bacteria in the air, nutrient agar and rose bengal-streptomycin plates were exposed regularly from 1959-1964. All exposures were made in the Pady-Pittis slit sampler on the roof of the Kansas State University building. Colonies were counted and numbers determined per cubic foot. Bacteria were present throughout the growing season, usually between 20 to 40/cu ft. Diurnal periodicity with twin peaks was observed with a major peak about 10 pm and a minor peak around 10 am. Further data collected over the growing seasons of 1959 through 1962 also revealed twin peaks, one at 9 pm and the other at 8 am. The reason for the double peaks remains unknown.

3105 APTIC NUMBER 20955

Pady, S. M. and C. L. Kramer
SAMPLING AIRBORNE FUNGI IN KANSAS FOR DIURNAL PERIODICITY. Rev. Palaeobotan. Palynol., vol. 4:227-232, 1967. 10 refs.

Studies were made with the Kramer-Collins Spore Sampler of numbers of fungus spores and pollen grains in the air through a 24-hour period. The sampler was located on top of a battery box, containing a standard 12 volt d.c. automobile battery, to which it was connected by a short section of 1 in. rubber tubing. The motor, pump, and flow meter were in a smaller box, and the flow rate was 0.8 cu ft per minute with samples taken every 20 minutes for a total of 10 minutes per hour. Silicone-coated slides were changed once daily. Diurnal periodicity in release and occurrence in the air was present in all forms studied with night time maxima for aeciospores of Puccinia andropogonis, ballistospores of Sporobolomyces, basidiospores of Coprinus, ascospores of Hyproxylon and Sordario, and day time peaks for Cladosporium, Cercospora, Alternaria, Helminthosporium and hyphal fragements. Pollen grains of Acalypha ostryaefolia had peaks from 6 to 7 am. (Author summary modified)

3106 APTIC NUMBER 21419

Perin, G., V. Gasparini, and C. Piccoli
AIR POLLUTION IN THE CITY OF BOLZANO. PART II: RESULTS AND REFLECTIONS ON FOUR YEARS OF STUDIES. (L'inquinamento atmosferico della citta di Bolzano. Nota II: Risultati e considerazioni di un quadriennio di Ricerche). Text in Italian. Ann. Sanita Pubblica (Rome), 30(5):795-831, 1969. 110 refs.

Air pollution studies in the city of Bolzano were begun in 1963 and interrupted at the end of 1964, at which time a city ordinance required the installation of smoke purifiers in home heating plants. Studies were resumed in September 1965 and terminated in the spring of 1967. At 6 sampling stations, the pH of rainwater was determined, as well as the presence of dust, calcium, magnesium, chloride, fluoride, sulfate ions, sulfur dioxide, chlorine gas, iron, fluorine gas, and aluminum; dust was additionally analyzed according to size of particulates. Meteorological conditions were also observed. Comparing the two periods of study, insoluble tarry substances notably decreased after the installation of smoke purifiers, while the content of insoluble inorganic pollutants increased, particularly at two stations. Chloride ion content was higher in the summer. Taking account of seasonal variations, the sulfur dioxide content was clearly reduced during the second period of study. In comparison with other cities, the residential areas of Bolzano showed better air quality than such areas in Melbourne, Naples, Modena, and London, while the industrial zone was about comparable to that of such large industrial complexes as Nagoya, Muenster, Mestre-Marghera, and Pittsburgh. Neither the industrial nor the residential zones gave values that exceeded the acceptable limits.

3107 APTIC NUMBER 20956

Peterson, James T.
THE CALCULATION OF SULFUR DIOXIDE CONCENTRATIONS OVER A METROPOLITAN AREA BY USING EMPIRICAL ORTHOGONAL FUNCTIONS. Preprint, American Inst. of Aeronautics and Astronautics, New York, 24p., 1970. 16 refs. (Presented at the American Institute of Aeronatuics and Astronautics Meeting, New York, 1970.)

Many theoretical and empirical investigations have studied the dependence between meteorological variables and pollutant concentrations, but most have focused on pollutant variation at a single source. The objective description of the patterns of city-wide distribution and their relation to meteorological variables can be used to calculate metropolitan sulfur-dioxide concentrations. Using eigenvectors, or empirical orthogonal functions, the distribution patterns of SO2 were determined over Saint Louis that were most significant in terms of the variance of the original observations explained by each pattern. Data for the statistical study were mean 24-hr SO2 concentrations at 40 sites during the winter of 1964-1965. The three basic patterns of SO2 distribution that were isolated accounted for nearly two-thirds of the observations' variance. Day-to-day variability of the derived patterns were largely explained by local meteorological conditions. Regression equations were formulated to relate the patterns and meteorology, then used on independent meteorological data to calculate city-wide SO2 concentrations. Eighty-one percent of the calculations were within a factor of 2 of the observations. The overall results were more accurate than those calculated from a mathematical dispersion model.

3108 APTIC NUMBER 20998

Popescu, I. Gr., Elena Capetti, I. Dragomir, and Ileana Dragul Escu
CONTRIBUTION TO THE QUANTITATIVE AND QUALITATIVE STUDY OF ATMOSPHERIC POLLEN AND FUNGI IN THREE TOWNS OF THE SOUTHERN SUBCARPATHIAN ZONE OF ROMANIA. Rev. Roumaine Med. Interne, 6(6):397-402, 1969. 8 refs.

The density of atmospheric pollen and fungi in three towns in Romania was studied over the period May-August, 1968. The investigation was conducted by means of Durham's method with slides and by cultures on Csapek medium. The quantity of atmospheric pollen was medium, seldom exceeding 350 granules per square centimeter. In May, the dominant pollen was that of trees and in other months, that of poaceae. The quantity of atmospheric fungi was relatively large, sometimes exceeding 120 colonies; the dominat fungi by far was cladosporium hormodendron. The relatively great variations as regards the quality and quantity of dominant fungi may be due to the conditions of climate and vegetation which vary widely from year to year. The investigation was undertaken because the number of periodic asthmatic patients was very large. (Author abstract modified)

3109 APTIC NUMBER 21618

Bank, D. M., A. F. Slomba, E. P. Gardner, and T. A. Wiggins
ABUNDANCE OF N2O IN THE ATMOSPHERE. J. Opt. Soc. Am., 52(8): 858-859, Aug. 1962. 3 refs.

Parts of the solar system were examined with a high-resolution spectrograph to determine the abundance of nitrous oxide. Measurements made on the 200-000 telluric band of N2O at 7.9 micron yielded integrated absorption coefficients for individual band lines. When these measurements were combined with laboratory-calibration spectral measurements, 2.0 plus or minus 0.3 mm path (normal temperature and pressure) was obtained for the amount of nitrous oxide present in a standard earth's air mass. (Author abstract modified)

3110 APTIC NUMBER 20957

Ripperton, Lyman A., James J. B. Worth, and Harvey Edward Jeffries
NITROGEN DIOXIDE IN THE NATURAL AIR AND ITS RELATIONSHIP TO OZONE. Technicon Corp., Ardsley, N. Y., Technicon Symp. Automation, Anal. Chem., New York, 1967, p. 417-421, 1968. 8 refs. (Oct 3, Paper 67A-92.)

For investigations of nitrogen dioxide as an ozone-destructive agent, a dual-channeled continuous sampling system was developed to provide accurate measurements on two levels. The system consists of air scrubbers with their associated pumps and flow meters, a 14-channel proportioning pump, time-delay coils, automatic solenoid valves, two colorimeters with tubular flow-cells, range expanders, and a two-pen recorder. The system operates with a modified Saltzman reagent. Measurements are presented in the form of graphs of the effect of turbulent eddies on O3 concentrations, relative changes of NO2 and O3 concentrations, monthly averages of NO2 and O3 concentrations, and hourly concentrations of NO2. Also presented are advective and gas-phase reaction terms accounting for ozone variations and computed concentrations of O3 destructive agents responsible for observed reductions. The data demonstrate the inverse relationship between NO2 and O3 concentrations. It appears that, on the average, reaction with NO2 accounts for 10 to 20% of the loss of O3 at night. The reaction probably accounts for considerably larger percentages of destruction of O3 over short time intervals. During daylight, the O3 tends to be higher, and the relative concentration of NO2 lower, than at night. Future experiments and observations will evaluate the diurnal changes noted.

3111 APTIC NUMBER 21013

Saito, I., K. Taguchi, A. Hashimoto, and H. Yamaguchi
INVESTIGATION ON THE AIR POLLUTION IN HITACHI DISTRICT. (Hitachi chiku no taiki osen ni tsuite (1)). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):4, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

In Hitachi, smoke particles, sulfur dioxide, and suspended particles were measured by means of deposit gauges, lead dioxide method, and automatic digital samplers at ten locations in the city. Hitachi was one of the first places (1907) in Japan to have the air pollution problem from the neighboring Hitachi Mines. Although pollution was not controlled in the '50's, an increase in the factories and population made the situation such that the city became the Smoke Regulation Area by national appointment. The main center of pollution is the cement factory with complaints originating within the radius of 0.5 to one kilometer. The amount of smoke particles and sulfur dioxide has been about the same in 1968 as in 1967, but there is an increase in warmer seasons rather than in the colder months. Various relationships with the meteorological factors were observed, and the graphical

representation of the proportion of Ca(++) ions (3%) in the total dust particles is presented together with the distribution of major industrial plants and the monthly distribution of dust fall in tons.

3112 APTIC NUMBER 21014

Saruta, N., Y. Katori, N. Ishinishi, and F. Kunitake
AMOUNT OF 3,4 BENZO(A)PYRENE IN FALLEN AND IN SUSPENDED DUSTS IN THE NORTHERN KYUSHU DISTRICT. (Kitakyuschuchiku ni okeru kokajinchu (1959-1967) oyobi fuyujinchu (1966-1968) no benzo(a)pyrene ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):144, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

In order to study the relationship between air pollution and the occurence of cancer, benzo(a)pyrene, b(a)p, was analyzed in tar obtained from the insoluble component of settling dust particles and in suspended dust particles from Fukuoka and Kita-Kyushu. Deposit gauges and air samplers were used to collect the dust particles, and b(a)p was analyzed by ultraviolet absorption and Cooper's methods. The quantity of b(a)p in micrograms per 1000 cu m or per cu m is tabulated for various areas, and is plotted for the time period between 1965 and 1968 for settling particles and over a period of about two years for suspended particles. The b(a)p quantity in the Kita-Kyushu industrial area is much higher than in the commercial area. Although the tar content in the particles from Fukuoka is about the same as that from the commercial area of Kita-Kyushu, the b(a)p content is only about 1 microgram /cu m, and the qualitative difference in the settling particles is obvious. Winter heating is considered to be closely related to the occurrence of smog in autumn and winter.

3113 APTIC NUMBER 21103

Stratmann, H.
FIELD EXPERIMENTS TO DETERMINE THE EFFECTS OF SO2 ON VEGETATION. PART II: MEASUREMENT AND EVALUATION OF SO2 GROUND LEVEL CONCENTRATIONS. (Freilandversuche zur Ermittlung von Schwefeldioxydwirkungen auf die Vegetation. Part II: Messung und Bewertung der SO2-Immissionen). Forschungsber. Landes Nordrhein-Westfalen, no. 1184, 69p., 1963. 19 refs. Translated from German. CFSTI Information Services, London (England), 58p.

As part of a project to determine levels of sulfur dioxide safe for plants, six stations were established in the vicinity of an iron mine and stocked with agricultural and silvicultural plants. Sulfur dioxide concentrations were measured continuously with an electroconductivity analyzer. The calculations required to identify constantly varying ground level concentrations in terms of parameters defining mean concentration, concentration-time-integral, variations in concentration, frequency of recovery periods, and frequency of concentration peaks are described. Because of their importance in relation to the onset of pollution effects, five weighting factors were formed from the individual parameters which characterized the pollution conditions. These in turn were reduced to a single degree of hazard comprising those parameters most important to characterize pollution with respect to its effects on plant response. The mathematical/statistical analysis of the degrees of hazard indicated that with this characterization, the pollution conditions at the individual experimental stations could be differentiated. Although the components of the hazard from SO2 can be characterized by means of the degree of hazard, it is not yet possible to draw definite conclusions about the onset of damage to the plant from the degree of hazard. The data from the extensive statistical analyses of SO2 measurements at the six stations are presented. (Author conclusions modified)

3114 APTIC NUMBER 21078

Styazhkin, V. M.
EXPERIMENTAL BASIS FOR THE DETERMINATION OF ALLOWABLE CONCENTRATIONS OF CHLORINE AND HCL GAS SIMULTANEOUSLY PRESENT IN ATMOSPHERIC AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 8:158-164, 1961. (B. S. Levine, ed.) CFSTI: 63-11570

An experimental basis for the determination of allowable concentrations for simultaneously present chlorine and HCl gas in the ambient air was obtained. Studies were conducted in the vicinity of a magnesium plant at 300, 500, 800, 1000, 2000, and 3000 m from the plant. Air samples were collected by the aspiration method through an absorber equipped with a porous plate No. 1. One absorber was filled with double distilled water; the other was filled with an acidified solution of methyl orange. Air samples collected through double distilled water were used for the determination of HCl aerosol by the titration method. Sulfuric acid, which interfered with analysis, was determined nephelometrically and subtracted from the titration result. Chlorine was determined colorimetrically in the sample. Results showed that chlorine and HCl gas concentrations were considerably in excess of the allowable maximal single concentration limit at all collecting points. The threshold of Cl odor preception was 0.7 mg/cu m and of HCl gas, 0.2 mg/cu m. Threshold odor perceptions of Cl and HCl gas simultaneously present in the air were established in the following combinations: 0.3 mg/cu m Cl, 0.1 mg/cu m and 0.2 mg/cu m Cl, 0.13 mg/cu m HCl. Results of the tests by the optical chronaxy method established the threshold of reflex effect of Cl and HCl gas simultaneously present in the air in the following concentration: 0.1 mg/cu m Cl, 0.2 mg/cu m HCl and 0.2 mg/cu m Cl, 0.3 mg/cu m HCl. The limit of maximal single concentration for Cl was 0.1 mg/cu m and for HCl, 0.05 mg/cu m. The simultaneous presence of Cl and HCl gas in the air in corresponding concentrations had no effect on the control curve of dark adaptation. Results showed that the concentrations were below the threshold of odor perception and reflex effect and below the allowable concentration limit.

3115 APTIC NUMBER 20470

Tachi, K., Y. Ose, S. Morishita, and H. Inoue
AIR POLLUTION IN OGAKI CITY. PART IV. (Ogaki-shi no taiki osen

(IV)). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(7):4, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Air pollution has been monitored in Ogaki since 1963. Results are presented for the investigation conducted from 1967 to 1969, in addition to the results of the around-the-clock measurements initiated since 1967 by means of sulfur dioxide automatic measurement devices and automatic anemometers. By means of alkali filter paper, sulfur oxides and nitrogen oxides were also monitored, and their monthly variations through each year are graphically represented. Sulfur dioxide does not vary much seasonally, but nitrogen oxide concentrations are low in summer and high in winter. The average geographical distribution of sulfur oxide and hydrogen sulfide concentrations over time are diagrammatically presented. In general, air pollution in Ogaki is not very severe, except for specific locations.

3116 APTIC NUMBER 20939

Tomson, M. M.
THE ACID-ALKALINE REACTION OF SETTLING DUST. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:102-108, 1963. 3 refs. (B. S. Levine, ed.)
CFSTI: 63-11570

The range of acid-alkaline reactions of settling dust was studied by pH measurement and by titration with one tenth N HCl. The pH of 387 dust samples ranged between 4.2-9.4. In most instances, the pH ranged within normal limits. Dust samples collected in industrial regions were predominantly alkaline reactions, while dust collected in inhabited and park sections were predominately acid reactions. The reactions shifted to the alkaline side during winter months and to the acid side during the warm seasons. Data showed that pH shifts to the alkaline or acid side were numerically the same in the dust collected in the industrial region, whereas in the inhabited regions, 40% of the shifts were in the acid direction, and in the dust samples collected in the park, such shifts amounted to 54.2%. Alkalinity of settling dust determined in 250 samples by titration was 6.24 in industrial regions, 4.59 in inhabited regions, and 2.92 in the park regions. The alkalinity was also slightly higher in winter months. It was concluded that acid-alkaline reactions of settling dust follow a definite pattern which should be taken into consideration when studying physiological effects.

3117 APTIC NUMBER 20549

Yas'kova, V. Z.
ATMOSPHERIC AIR POLLUTION BY OIL-DRYING PLANT DISCHARGES. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:96-98, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

Measurements were made of the presence of aldehydes, especially acrylic aldehyde (acrolein), in the indoor and outdoor atmosphere around an oil-drying plant. Acrolein is a colorless, highly volatile fluid; acrolein vapor is twice as heavy as air, and though stable under normal conditions, becomes converted to formic and acetic acids in the presence of strong oxidizers. Toxicologically it is classed as a strongly irritating substance. Ninety-eight samples were collected (25 in residences, 73 outdoors) by the aspiration method; aldehyde was determined colorimetrically by the fuchsin-sulfurous acid reaction. Average aldehyde concentration in the atmospheric air within 400 m from the plant was the same as in the indoor air; at 500 m, the indoor concentration was twice that of outdoors. This may have been due to the fact that aldehydes penetrate easily into living quarters and tend to accumulate where ventilation is poor, while in open air concentrations are diluted by prevailing winds. It is recommended that because of the excessive aldehyde concentrations found in the ambient air around such plants a maximum allowable concentration value should be adopted.

3118 APTIC NUMBER 20711

Yazawa, H., Y. Watanabe, S. Wakamatsu, and K. Goi
CHARACTERISTIC FEATURES OF CONTINUOUS AIR QUALITY BY STATISTICAL METHOD. PART I. (Nodo tokeiretsu no kaiseki). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):13, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Statistical analyses were conducted on the pollution structure of sulfur dioxide for six cities based on the cumulative frequency distribution of its average hourly concentration. The frequency distribution of pollution concentration is known to be log-normal, and a leftward shift of its graph would indicate a reduction in emission, assuming that the scale of the pollution area and meteorological factors are statistically invariant. The graphical analysis of the data from the cities according to workdays and non-workdays indicated that while there is a definite shift to the left on non-workdays for ordinary cities, there is very little change for industrial cities. Some cities have distributions determined by the quantity of emission and others, by the source locations due to seasonal influences. It is difficult, however, to generalize the distribution by approximation to log-normal, i.e., data from different cities cannot be compared by expectations and variances alone. Thus a new correction variable was introduced to transform the mathematical formulation, thereby linearizing the distribution into a normal distribution.

3119 APTIC NUMBER 20997

Allen, E. E.
CHEMICAL FACTORS REGULATING FREE ALKALI METAL ATOMS IN THE UPPER ATMOSPHERE. J. Geophys. Res., 75(15):2947-2950, May 20, 1970. 14 refs.

In constrast to daytime and twilight emissions, which result from resonant scattering by free alkali metal atoms, the nightglow emission is probably due to chemical reaction of alkali metal compounds. It is proposed that recombination of atomic nitrogen on a metal salt particle in a dust layer is a possible mechanism leading to emission by alkali metal atoms. Weak emission from the first negative band system of atomic nitrogen may be observed concurrently. The chemical stability of sodium salts is investigated. The effect of atom bombardment on two types of meteoritic material to determine whether such exposure might produce atomic sodium suggests that, because of high recombination coefficients observed, a layer of meteoritic dust at about 90 km would greatly perturb the atomic-particle density near this altitude. (Author abstract modified)

3120 APTIC NUMBER 21614

Angstrom, Anders and Linus Hogberg
ON THE CONTENT OF NITROGEN (NH4-N AND NO3-N) IN ATMOSPHERIC PRECIPITATION. Tellus (Uppsala), 4(1):31-42, Feb. 1952. 2 refs.

The nitrogen content of precipitation is of interest both from an agricultural viewpoint and a geophysical one. Preliminary results of observations conducted at Uppsala yield useful data on the subject. The concentration of the compounds studied in precipitation is dependent upon the amount of precipitation previously fallen. The almost constant ratio of 2:1 in which the compounds appear seems to suggest a common origin. Nitrogen content is independent of the time of year and of the occurrence of thunderstorms. A pronounced dependence of the concentration on the character of the air mass exists. Thus, the tropical air contains between 10 and 30% greater amount of nitrogen than the polar air, and almost double the amount found in the arctic air. A mathematical expression is given for the dependence of concentration on amount of precipitation fallen. (Author abstract modified)

3121 APTIC NUMBER 21099

Arin, M. L., C. E. Billings, P. Dennis, J. Driscoll, D. Lull, F. A. Record, P. Warneck, and J. F. Wilder
STUDY OF REACTIONS OF SULFUR IN STACK PLUMES. (SECOND ANNUAL REPORT). GCA Corp., Bedford, Mass., Technology Div., NAPCA CONTRACT PH-86-67-125, GCA-TR-69-12-G, 85p., Dec. 1, 1969. 10 refs.
CFSTI: PB 188982

The results of the second year of a three-year study of the reactions of sulfur in stack plumes are presented; the basic program objective was to provide an improved capability for predicting sulfur oxide concentrations in urban atmospheres. The field program of airborne sampling of plumes from coal- and oil-fired power stations in the Boston area was extended, with concurrent measurements of flue gas composition, plant parameters, and environmental factors. SO2 and SF6 tracers were tracked up to 20 miles downwind; beyond visible range, plume locations were determined by an automatic conductivity analyzer. Sampling procedures and other program conditions were developed in part on the basis on model analysis. The normal SO2 concentration decrease from meteorological dilution was distinguished from SO2 loss caused by chemical and/or physical mechanisms. Results of statistical analysis of field and stack data are given although technical and statistical difficulties prevented firm conclusions. Coal-burning tests made in a pilot plant combustion system showed that real field effluents could be generated in a laboratory over extended periods for simulated decay studies. Preliminary decay measurements of SO2-air mixtures were performed in a reaction chamber, and appeared to support the hypothesis that major atmospheric SO2 loss is associated with condensation phenomena. Experiments on reaction kinetics were also performed in a hemispherical reaction vessel in which quantum yields for SO2-O2 mixtures over the range 10-100% SO2 could be determined. Methods, equipment, and interim results are given for all phases of the overall study, and descriptions of the combustion gas pilot plant and of the diffusion models used in the design and evaluation of the field program are included in the appendices.

3122 APTIC NUMBER 21182

Assaf, G.
EMANATED PRODUCTS AS A PROBE OF ATMOSPHERIC TRANSPORT. Tellus (Uppsala), 820-828, 1969. 16 refs.

Atmospheric transport of radon, thoron, and their decay products is analyzed in the light of the Richardson diffusion theory, replacing the length scale by a time scale. The mean operation involved in the usual procedure of parameterization eddy diffusion must be related to the isotopic mean life, and its relation, to spectra of atmospheric turbulence. There are cases where the conventional parameterization of eddy diffusion is inconsistent and contradictory; for example, thoron distribution generally must be treated by Richardson formalism. The conventional methods are reasonable for interpretation of radon (222) and Pb (212) Profiles, provided this is done carefully. The vertical transport due to the mean wind cannot be neglected, as sometimes it is a dominant factor. A criterion for estimating the relative importance of advection and eddy diffusion is derived. Application of this criterion established that, in the free atmosphere, radon transport is generally dominated by advection. This result is demonstrated by semi-uniform numerical model. (Author abstract modified)

3123 APTIC NUMBER 21514

Ball, Robert J.
METEOROLOGICAL EFFECTS ON AIR POLLUTION AT SELECTED LOCATIONS IN

CONNECTICUT AND A METEOROLOGICAL TOOL FOR ASSESSING EMISSION ABATEMENT. Preprint, Connecticut State Dept. of Health, Hartford, Air Pollution Control Section, 15p., April 7, 1969. 8 refs.

Smoke shade and weather data were analyzed for Hartford and Fairfield, Connecticut to study the meteorological aspects of air pollution, with reference to where and when maximum levels occur and the conditions causing these levels. The effect of the urban heat island, described as a 'bubble' of slightly unstable to stable air enveloping the city and imbedded in a general inversion, was significant in producing the highest average levels in urban areas at night. This same phenomenon 'spares' the surrounding rural areas from urban emissions. Summer and fall data indicate a frequency of occurrence of 20-25%. Two automated objective techniques based on standard diffusion equations are considered for continuous assessment of the effectiveness of abatement programs. Both use air quality data and concurrent meteorological data. In the pollution wind rose technique, mean smoke shade for a given day is plotted on a wind rose technique, mean smoke shade for a given day is plotted on a wind rose diagram at the ventilation index value computed for that day; values are isoplethed and significant sources are thus indicated. Since this method does not take into account the effect of the distance of the source from the receptor, the equivalent line source technique is preferred. Using a line source equation, source distance can be accounted for, and therefore actual emissions can be estimated.

3124 APTIC NUMBER 21174

Bicket, Nadine A. and Gilmer A. Gary
MIE SCATTERING: A COMPUTER PROGRAM AND AN ATLAS. George C. Marshall Space Flight Center, Huntsville, Ala., Space Sciences Lab., NASA TM-53951, 97p., Sept. 29, 1969. 5 refs.
CFSTI: N 70 17291

A computer program for calculating the Mie scattering parameters is presented with applications to distributions of particle size and different lens apertures of a detector. MIESCA, the computer program, calculates the amplitude functions, efficiency factors, intensities, and polarizations, and it was adapted for magnetic tape filing in the Univac 1108 and for plotting intensities and polarization versus scattering angle on the SC 4020 plotter. An appendix and an atlas of scattering intensity graphs are included. This report provides a basis to evaluate characteristics of the radiation scattered by a dilute cloud of particles. (Author summary)

3125 APTIC NUMBER 20920

Bowling, Sue Ann, Takeshi Ohtake, and Carl S. Benson
WINTER PRESSURE SYSTEMS AND ICE FOG IN FAIRBANKS, ALASKA. J. Appl. Meteorol., 7(6):961-968, Dec. 1968. 12 refs.

The overall synoptic conditions responsible for ice fog in interior Alaska were investigated, in order to show the effects of advective and dynamic processes in producing or inhibiting the production of the low temperatures and to some extent the steep inversions which lead to the ice fog formation. Examination of the meteorological conditions associated with 15 periods of dense ice fog at Fairbanks indicates that local radiative cooling is important only in producing the observed steep ground inversion. The most rapid decreases in temperature at heights great than 1 km occurred with cloud cover and cold air advection preceding the cold weather at the ground. The most common synoptic pattern (observed for the 12 shortest events) consisted of the migration of a small high from Siberia across Alaska. Rapid growth of the high was common, and the resulting subsidence was strong enough to counterbalance not only radiative cooling, but further cold air advection as well. This resulted in an observed warming aloft during all but the first 12-24 hr of the clear, cold weather observed at the ground. Three of the 15 events did not follow this pattern including two long and very cold events associated with warm highs in northeastern Siberia, continuous belts of moderately high pressure extending from Siberia across the Bering Strait into Alaska, and advection from Siberia and the Arctic Ocean. The remaining long but relatively mild event was associated with a warm high north of Alaska and advection from Canada and the Arctic Ocean. (Author abstract modified)

3126 APTIC NUMBER 20975

Briggs, G. A.
PLUME RISE. Oak Ridge, Tennessee, Atomic Energy Commission, Div. of Technical Information, Nov. 1969, 81p. 150 refs.
CFSTI: TID-25075

Plume diffusion is discussed with respect to aerodynamic effects due to the presence of the stack, buildings, and topographical features; plume rise, relative to the mean motion of the air, due to buoyancy and initial vertical momentum of the plume; and diffusion, due to turbulence in the air. Plume rise observations made in the atmosphere, in wind tunnels, in towing channels, and in trucks are reviewed, and an attempt is made to fit previously derived empirical formulas to data obtained in the observations. Each existing formula is shown to be unapplicable to all plume rise conditions, and a simple theoretical model is derived that fits most of the data. The model makes use of the simplest workable entrainment and drag-force assumptions, simple approximations for the atmosphere treats the plume as being either nearly vertical or nearly horizontal. The inverse wind speed relation generally valid for the rise of a hot plume at a fixed distance downwind in near-neutral conditions. Nine formulas of this type are compared with data from 16 different sources. The best agreement is obtained from the 'two-third law' according to which plume rise above the top of the stack equals 1.6 $F^{1/2}$ reciprocal $U^{2/3}$, where F is byouancy flux parameters; U the average wind speed at stack level; and X, the horizontal distance downwind of the stack. The formula is modified by an assumption that a ceiling height is reached at a distance of ten stack heights downwind. Formulas are also presented for predicting the rise of buoyant plumes in neutral stratification and under calm conditions. Formulas of a similar type are recommended for nonbyouant plumes on the basis of such more limited data. (Author abstract modified)

3127 APTIC NUMBER 21681

Byzova, N. L., V. N. Ivanov, E. K. Garger, and V. S. Osipov
USE OF STATISTICAL WIND CHARACTERISTICS FOR THEORETICAL AND EXPERIMENTAL ESTIMATION OF PASSIVE PARTICLE DIFFUSION. J. Geophys. Res., 75(18):3605-3609, June 20, 1970. 23 refs.

Research on smoke plumes and small particles has shown the possibility of using the Lagrangian model of diffusion; a connection between Lagrangian and Eulerian turbulence makes it possible to compute small-scale dispersion in the atmosphere. Comparison of turbulence characteristics (turbulent energy dissipation, Lagrangian time scale) obtained from Lagrangian and Eulerian measurements show good correlation. (Author abstract modified)

3128 APTIC NUMBER 20607

Calikov, D. V.
ON WIND AND TEMPERATURE PROFILES IN THE SURFACE LAYER OF THE ATMOSPHERE WHEN STRATIFICATION IS STABLE. Tr. Gl. Geofiz. Observ. (Leningrad), vol. 207:170-174, 1968. 5 refs. Translated from Russian by C. Long, Meteorological Office, London, England, 5p.

The applicability is tested of two formulae relating to the turbulence conditions in the surface layer of the atmosphere most often observed in temperature inversions. An attempt is also made to determine certain numerical constants in the formulae by processing only gradient observations of wind and temperature, using a digital computer. Data from Mirny Station, Antarctica, where temperature inversions are the predominant type of stratification, were used; a total of 503 pair of profiles were processed. Computations and results are discussed.

3129 APTIC NUMBER 21216

Chaudhry, Faral H. and Robert N. Meroney
TURBULENT DIFFUSION IN A STABLY STRATIFIED SHEAR LAYER. Colorado State Univ., Fort Collins, Fluid Dynamics and Diffusion Lab. ECOM Contract DAAB07-68-C-0423, Task IIB, TR-C-0423-5, ECOM Rept. CER69 - JC FHC - PWM 12, 187p., Sept. 1969. 73 refs.
CFSTI, DDC: AD 699376

Diffusion of a passive substance released from a continuous point source in a stably stratified shear layer is investigated both theoretically and experimentally. Using Monin-Obukhov's velocity profile and assuming a vertical eddy diffusivity which is a power function of the stability parameter z/L, the Eulerian turbulent diffusion equation is solved to obtain expressions for vertical and longitudinal velocities of the center of mass of a cloud in the constant stress region. Experimental investigation was carried out in a wind tunnel in which a stably stratified shear layer was produced by heating the air and cooling the wind tunnel floor. Detailed observations of the diffusion field, downwind ground and elevated point sources, were made using Krypton-85 as a tracer. Concentration characteristics obtained from diffusion experiments show excellent agreement with those observed in the atmosphere, and the data compares well with the predictions of similarity theory. The assumption is supported of a Gaussian effect of source height, for elevated releases, on the ground level concentration. Examination of the available solutions to the three dimensional diffusion equation as compared to the data suggests that the detailed diffusion patterns obtained from the wind tunnel experiments may be preferable over such solutions which require arbitrary specification of a lateral diffusivity. (Author abstract)

3130 APTIC NUMBER 21169

Collins, George F.
METEOROLOGY IN A CHEMICAL INDUSTRY. Weatherwise, 6(2):34-35, April 1953.

Meteorologists at a chemical company assist in proper site selection, giving advice on location and size of stacks for new plants, conduct climatological studies, and provide short-range weather forecasting to fit the needs of construction activities. Vegetation and air sampling surveys determine the state of health of the area for a new project, and the combined effect of all the new stacks must be added to already existing conditions. A thorough knowledge of microclimate and terrain is essential, for with this necessary data, stack heights can be determined from the Bosanquet and Pearson formula for the dispersion of stack gases. In the case of short stacks where the geometry of adjacent buildings or terrain are determining factors in smoke-plume behavior, recourse has been made to tests in a low-speed wind tunnel. Design of air conditioning equipment, cooling towers, storm sewers, waste retention basins, and foundations all require climatological knowledge. One recent project studied the pattern of soil temperatures at various depths, yielding information valuable for determining needed pipeline insulation and probable frost penetration.

3131 APTIC NUMBER 21277

Crutzen, P. J.
THE INFLUENCE OF NITROGEN OXIDES ON THE ATMOSPHERIC OZONE CONTENT. Quart. J. Roy. Meteorol. Soc. (London), vol. 96:320-325, 1970. 20 refs.

Recently measured nitric acid concentrations in the stratosphere tend to support the hypothesis that nitrous oxide, produced possibility by microbiological action in the soil and diffusing upward through the troposhere, say be partly converted to 'odd nitrogen' (NO and NO2) by a photodissociation process in the stratosphere. This paper considers the direct controlling effect of NO and NO2 concentrations on ozone distribution in the stratosphere and their subsequent effect on atmospheric ozone production rates. A reaction scheme for the photolysis of ozone is proposed. Special attention is given to the reduction of odd oxygen by odd nitrogen. As indicated by estimates of the daily

production and destruction of odd oxygen below 50 km at the equator, reduction of odd oxygen by odd nitrogen is dominant between 25 and 40 km. In the stratosphere, reduction of odd oxygen by OH and HO2 may be of greater importance.

3132 APTIC NUMBER 20986

Das, Phanindramohan
ON THE CONCENTRATION OF PRECIPITATION PARTICLES IN CONVECTIVE STORMS. J. Atmospheric Sci., vol. 27:330-333, March 1970. 4 refs.

An equation of conservation of particles as derived by previous investigators in a theoretical study of the change of growing precipitation particles in a steady-state one-dimensional is critically reviewed. In order for there to be no accumulation of particles at the turn-around level, as proposed, the unsteady phase must be of infinite duration, a fact that is highly unlikely. The concentration has be be infinite at the turn-around level in the case of a discrete distribution. In a rebuttal appended to the article, it is demonstrated that infinite time is not required to reach the steady-state; thus, the particle number in any volume will be finite, even though the turn-around level is included in the volume. There is no accumulation of particles in the turn-around level, since for each particle that reaches it there is one that leaves it.

3133 APTIC NUMBER 21304

Dave, J. V. and J. Gazdag
A MODIFIED FOURIER TRANSFORM METHOD FOR MULTIPLE SCATTERING CALCULATIONS IN A PLANE PARALLEL MIE ATMOSPHERE. Appl. Opt., 9(6):1457-1466, June 1970. 31 refs.

A method for evaluating characteristics of the scattered radiation emerging from a plane parallel atmosphere containing large spherical particles is discussed. The normalized phase function for scattering is represented as a Fourier series; the maximum required number of terms depends upon the zenith angles of the directions of incident and of scattered radiation. Some results are presented to show that this method can be used to obtain reliable numerical values in a reasonable amount of computer time. (Author abstract)

3134 APTIC NUMBER 20991

Dyer, A. J.
ANISOTROPIC DIFFUSION COEFFICIENTS AND THE GLOBAL SPREAD OF VOLCANIC DUST. J. Geophys. Res., 75(15):3007-3012, May 20, 1970. 6 refs.

The global spread of volcanic dust from the Mt. Agung eruption of March, 1963, is assessed on the basis of the decrement in direct scolar radiation. The data suggest the establishment of an equatorial reservoir at height of about 22 km, followed by poleward transport into each hemisphere during winter. The poleward-moving waves of dust appeared to have constant amplitude in any one season with a poleward progression rate of 40 cm/sec between 30 and 60 deg latitude. Analytic solutions are found for the diffusion coefficients K sub YY and K sub XY for the following cases: (1) no mean motion; (2) a three-cell pattern for the meridional circulation; and (3) same as (2) but with assumption of also stratospheric source of dust particles from gaseous products of the volcano. The results for K sub YY are in general agreement with findings of other workers, but the values of K sub XY appear to be too high, particularly in the region 30-60 degrees latitude. It is speculated that better agreement could be found if the diffusion coefficients were chosen to vary seasonally. (Author abstract modified)

3135 APTIC NUMBER 20978

Elderkin, C. E., T. W. Horst, and J. C. Draper
ATMOSPHERIC TURBULENCE STUDIES. In: Pacific Northwest Laboratory Annual Report for 1968 to the USAEC Division of Biology and Medicine. Vol. II: Physical Sciences Part I. Atmospheric Sciences. Battelle-Northwest, Richland, Wash., Pacific Northwest Lab. p. 14-17, Nov. 1969. 3 refs
CFSTI: BNWL-1051

Seventeen turbulence experiments were performed with the Hanford Wind Component Meter, measuring temperature and the three components of the wind at various heights up to 24.4 m during widely varying stability conditions. Simultaneous measurements were made of the mean profiles of temperature and wind speed and direction. During four of these experiments, the WCM was at 3 m and a sonic anemometer-thermometer was at 60 m, which gave data that are useful for further determination of the height dependence of turbulence characteristics and for determination of the vertical divergence of meteorological fluxes. Finite values of the measured mean vertical velocity indicate that greater care is necessary to orient the sonic anemometer within plus or minus 0.3 deg in the vertical. (Author abstract modified)

3136 APTIC NUMBER 20992

Ghosh, S. N., A. N. Srivastava, and P. V. Shukla
EXPERIMENTAL STUDY OF NO2 CONTINUUM IN THE AFTERGLOW OF N2 AND O2 MIXTURE. Ann. Geophys., 26(1):53-58, 1970. 20 refs.

A greenish-white afterglow of nitrogen dioxide (NO2) continuum was produced in a mixture of oxygen and nitrogen gases. Spectroscopic and photometric observations revealed that its intensity is maximum at six thousand angstroms. The effect of temperature on the intensity of the continuum and the quenching by nitrogen and oxygen gases were studied. From the effect of temperature on the continuum, it follows that the height of NO2 continuum in the night airglow is situated at eighty to ninety kilometers. The experimental arrangement for the study is described. An excitation mechanism for the emission of NO2 continuum is proposed. (Author abstract modified)

3142 APTIC NUMBER 21701

Haenel, Gottfried
THE SIZE OF ATMOSPHERIC AEROSOL PARTICLES AS A FUNCTION OF THE RELATIVE HUMIDITY. (Die Groesse atmospharischer Aerosolteilchen als Funktion der relativen Luftfeuchtigkeit). Text in German. Beitr. Physik Atmosphare, vol. 43:119-132, 1970. 21 refs.

A model for the equivalent radius of atmospheric aerosols as a function of the relative humidity is developed. Equivalent radius is the radius of the sphere with the same volume as the particle. The model contains only parameters which can be directly determined by measurements on atmospheric aerosols. This makes the model applicable for the entire humidity range. Preliminary results of measurements on atmospheric aerosols at Mainz and on sea salts were used for calculations. Simplified but generally applicable equations were obtained in the range of less than 0.95 as well as for aerosols and sea salt particles with equivalent radii of larger than 0.4 micron in the dry state. These simplified equations can be used for calculating the refractive index and the light extinction of aerosol particles.

3138 APTIC NUMBER 20566

Hanna, Steven Rogers
A MODEL OF VERTICAL TURBULENT TRANSPORT IN THE ATMOSPHERE. Pennsylvania State Univ., University Park, Dept. of Meteorology, Thesis (Ph.D), Ann Arbor, Mich., Univ. Microfilms, Inc., 1969, 72p. 41 refs.

A universal method was developed for estimating the vertical eddy diffusivity K that can be applied whenever turbulence exists in the atmosphere. The method derived is based on physical reasoning verified by observations. Dimensional analysis was utilized to obtain functional forms for the vertical eddy diffusivity. The basic hypothesis is that the mixing efficiency depends on parameters that also completely characterize the energy spectrum of the fluctuations of the vertical wind speed; the standard deviation of the vertical velocities; the wave number of the eddies that carry the maximum amounts of vertical turbulent energy; and the rate of dissipation of turbulent energy per unit mass. The empirical relations described can be used to estimate the eddy viscosity at any height within the atmospheric boundary layer using data near the ground. The results demonstrate that many properties of the turbulent field in the atmospheric boundary layer are universal, and that a valid theory can be deduced to explain the vertical transport mechanisms in this region of the atmosphere. The theory permits the vertical flux of any substance per unit area to be estimated from a measurement of the average vertical gradient of the substance and measurements of the vertical velocity fluctuations. (Author summary modified)

3139 APTIC NUMBER 21436

Hess, R., W. Frank, and I. Koeck
CHARACTERISTIC TEMPERATURE OF AN AEROSOL IN A TURBULENT ATMOSPHERE. (La temperature propre de l'aerosol en atmosphere atitee). Text in French. J. Mech. Atmospheriques, 4(1):7-18, 1969. 11 refs.

An aerosol located in a turbulent atmosphere can be expected to behave in the same manner as an aerosol located in a quiet atmosphere, except that the former will have a higher temperature than the surrounding air. The 'characteristic temperature' formula for suspended particles that are subject to a periodic motion is derived and demonstrated by observing the distribution of a hydrosol inside an agitated mass. An explanation is given of the importance of the characteristic temperature for the behavior of fog and the formation of rain. The characteristic temperature of the gas in an aerosol cannot be determined by a thermometer, which deals in averages, and will therefore yield a value reflecting the temperature of the surrounding air. The characteristic temperature will be a function that varies in dependence on the speed of dispersion or the distribution of the aerosol in term of the altitude. The relatively large amount of energy imparted to the aerosol in the form of kinetic energy is transferred to the air surrounding the particles, which is in the form of heat energy. A rather large part of the kinetic energy of the air-aerosol mixture in the process of being slowed up is received by the mass of air responsible for the slowing operation, in the form of transformation energy, producing explosive temperatures. A part of the original kinetic energy of the air and of the aerosol escapes into the surrounding atmosphere, with a corresponding pressure disturbance, traveling at the speed of sound, also creating characteristic aerosol temperatures.

3140 APTIC NUMBER 20884

Hoidale, G. B., A. J. Blanco, N. L. Johnson, and R. V. Doorey
VARIATIONS IN THE ABSORPTION SPECTRA OF ATMOSPHERIC DUST. Army Electronics Command, Fort Monmouth, N. J., DA Task 1T061102B53A-20, ECOM-5274, 31p., Oct. 1969. 7 refs.
CFSTI, DDC: AD 697108

Six impactor and 99 membrane filter samples of atmospheric dust were collected on top of a mountain in south central New Mexico during April and May 1968. Qualitative analysis of these samples by infrared absorption spectroscopy in the 4000 -250 reciprocal cm wavenumber (2.5-40 micron wavelength) range revealed that the positions and relative intensities of the absorption bands were dependent on the size fraction of the dust and on the time the sample was taken. Within the 1250-770 reciprocal cm (8-13 micron) atmospheric window, the micron-sized (giant) particles exhibited a peak absorption at 1027 reciprocal cm (9.7 micron), whereas the submicron (large) particles had their peak absorption at 1108 (9.0 micron). These two absorption bands are induced, respectively, by silicate clays and by ammonium sulfate. A temporal variation was observed in the ratio of the intensities of the 1027 reciprocal cm (9.7 micron) silicate and the 1425 reciprocal cm (7.0 micron) carbonate absorption bands of the giant particles. This ratio was high during the early morning, at times of convective activity and precipitation, and at times of cold frontal passage from the east; it was low during the

afternoon and at times of convective inactivity and no precipitation. The low ratio dust is attributed to advection of fresh soil particles from the exchange layer over the adjacent basin and mountains and the high ratio dust to advection of fresh soil particles from the Great Plains and aged soil particles from the overlying free atmosphere. (Author abstract modified)

3141 APTIC NUMBER 21175

Howell, H. B.
ANGULAR SCATTERING FUNCTIONS FOR SPHERICAL WATER DROPLETS. Naval Research Lab., Washington, D. C., Atmospheric Physics Branch, NRL Prob. A03-10, Proj. A37540/652/69-R004-02-01, NRL Rept. 6955, 112p., Oct. 8, 1969. 6 refs.
CFSTI, DDC: AD 698492

Tables and graphs are presented which give the angular distribution of scattered light from spherical particles having a refractive index 1.33 (e.g., water droplets in air). The 50 particle sizes include the size parameters 1(1)20, 22(2)50, 55(5)125, and the scattering angles 0(0.2)180-deg in the graphs and 0(2)180-deg in the tables. The computational procedure is given in detail, and the FORTRAN programs are listed. For incident light of wavelength 0.63 micron, the range of particle size (radius) covered is approximately 0.1 to 12.5 micron. Droplets in this range are commonly found in natural haze, fog, and clouds. (Author abstract)

3142 APTIC NUMBER 21180

Kao, S.-K. and Donald Henderson
LARGE-SCALE DISPERSION OF CLUSTERS OF PARTICULATES IN VARIOUS FLOW PATTERNS. J. Geophys. Res., 75(15):3104-3113, May 20, 1970. 11 refs.

The relative particle displacement tensor, eddy diffusivity, power spectra, and cospectra of the relative particle velocities for clusters of particles were studied for the following six flow patterns: cyclonic centers, anticyclonic centers, trough, ridge, and inflection points to the east and west of troughs in the midtroposphere. The zonal component of the eddy diffusivity was about five times the meridional component, the eddy diffusivity for winter was greater than that for summer. The zonal component of the eddy diffusivity was greatest for releases at the inflection point to the west of troughs, whereas the meridional component was greatest at cyclonic centers. The smaller value of both the zonal and the meridional components of the eddy diffusivity was the value for releases at anticyclonic centers. The principle axis of diffusion was mostly orientated WSW-ENE for summer releases and WNW-ESE for winter releases. For large diffusion times, the mean square of the zonal component of the relative particle displacement was approximately proportional to the first power of time, whereas the mean square of the meridional component showed a wavy characteristic, which indicates the effect on the meridional motion of planetary waves. The power spectra of the zonal component of the relative particle velocities were similar in all cases and showed an increase in turbulent kinetic energy with decreasing frequency, whereas the spectra of the meridional component showed an energy peak near 0.01 cycles/hr. In the high-frequency range, the spectra of both the zonal and meridional components of the relative velocities were inversely proportional to the frequency cubed. (Author abstract)

3143 APTIC NUMBER 21114

Kelley, J. J., D. F. Weaver, and B. P. Smith
THE VARIATION OF CARBON DIOXIDE UNDER THE SNOW IN ARCTIC. Ecology, 49(2):358-361, Spring 1968. 9 refs.
CFSTI, DDC: AD 676402

Atmospheric carbon dioxide was monitored continuously by infrared analysis near Barrow, Alaska, from September 1965 to July 1966; tundra surface temperature and wind speed four meters above the ground were measured simultaneously near the study area. Thermocouples were located at 8, 4, and 2 cm above the tundra surface; at the surface; and 2, 4, 8 and 16 cm below it. Average daily surface values of carbon dioxide as measured at the tundra surface increased a few days after the first snowfall, and high and variable values occurred until early December and then decreased to lower, relatively stable concentrations that persisted to early May. At that time, the carbon dioxide concentrations under the snow increased until the snow left the tundra in late June. There was a general positive correlation between surface temperature and carbon dioxide, and an inverse relationship with wind speed. (Author abstract modified)

3144 APTIC NUMBER 20614

Khrgian, A. Kh.
VERTICAL DISTRIBUTION OF ATMOSPHERIC OZONE. (O vertikal'nom raspredelenii atmosfernogo ozona). Geomagnetizm i Aeronomiya, no. 2:317-322, 1967. 7 refs. Translated from Russian. Office, Assistant Chief of Staff for Intelligence (Army), Washington, D. C., 7p., 1968.

The principal characteristics of the vertical distribution of atmospheric ozone in different latitudinal zones in the troposphere and the stratosphere are reviewed on the basis of data obtained by U. S. ozone probes in the winter of 1962-1963 and during observations of the ultraviolet radiation at the zenith of the sky in Arosa (Switzerland) in 1962-1964. The small amount of ozone in the troposphere and its significant increase in the stratosphere is characteristic. Directly above the tropopause, both partial pressure and density of ozone begin to increase sharply with altitude. The altitude and structure of the tropopause could be verified by the ozone probe data. In the upper layer of the stratosphere, the ozone follows the change in solar radiation, increasing from a minimum in December to a maximum in June. The ozone concentration gradient in the troposphere decreases significantly from the subtropics to the pole. The transfer of ozone from the stratosphere to the troposphere probably decreases toward the pole. Although the lower stratosphere at the pole is rich in ozone, it

apparently supplies very little ozone to the troposphere below it, since the exchange of air through the troposphere is weak in this area. Neither the intensity nor the location of the principle flows, nor even the sources, of ozone in the troposphere are yet understood.

3145 APTIC NUMBER 20606

Klingo, V. V. and M. I. Onikul
ABSORPTION OF GASEOUS IMPURITIES BY FOG DROPLETS. (O pogloshchenii gazoobraznykh primesei kaplyani tumana). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no. 214:80-84, 1968. 9 refs.

The effect of fog droplets on the turbulent diffusion of impurities in air is examined theoretically. The motion of fog droplets slightly lowers the absorption of impurities and hence gravitational precipitation may be neglected. The analysis presented may be used to study the capture of impurities by clouds, and the evaporation of fine droplets. At low Reynolds number, droplet evaporation is somewhat less than for the stationary case.

3146 APTIC NUMBER 21033

Kohl, G.
ON THE QUALITATIVE DEMONSTRATION OF COSMIC LAYERS OF DUST PARTICLES IN THE MESOPAUSE WITH THE AID OF TWILIGHT OPTICAL METHODS AND THE APPEARANCE OF LUMINOUS NIGHT CLOUDS. (Der qualitiative Nachweis von Schichten kos-mischer Staubpartikeln in der unteren Thermosphaere mit Hilfe der daemmerungs-optischen Methode und das Auftreten Leuchtender Nachtwolken). Text in German. Z. Meteorol., 21(5-7):165-174, Dec. 1969. 36 refs.

Measurements of light scattered from the twilight sky in the range of the zenith showed occasional strong fluctuations that are due to refined evaluating methods at Abastumani (Grusinian SSR), Wahnsdorf, and on the Fichtelberg. The difference between the secondary maxima and minima in the range of average twilight phases represents a measure for the concentration of optically effective dust particles near the mesopause and beyond. Between 41 and 51 deg N, annual variations of these differences show a parallel course and coincide with the frequency distribution of noctilucent clouds. In summer, the center of the dust layer is just above the mesopause; in winter, it is at higher altitudes. In transition seasons, a zone of rarified dust separates the upper and lower dust layers. The variation of the polarization rate within the range of the anomaly can be considered as the profile for dust concentration of presumably cosmic origin. (Author abstract modified)

3147 APTIC NUMBER 20631

Konishi, T. and M. Miura
ON THE AIR POLLUTION BY IRON WORKS. (Seitetsusho kara no osen ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):146, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

An iron works with five blast furnaces and a production capacity of 8.5 million tons per year is in the northwestern part of Wakayama, facing the sea, and the pollution due to its emission is believed to reach 75% of the whole city. Beginning in 1969, a great deal of money has been funded in order to prevent future pollution damage to the surrounding residential area. Various data on wind direction and velocity and sulfur dioxide concentration in the atmosphere measured by lead dioxide and electric conductivity methods are tabulated. The tables indicate that there are seasonal variations in concentrations according to the wind direction. For example, the city is polluted all year round by south wind, and in spring, summer and autumn by west wind. In addition, the relationship between high concentrations of sulfur dioxide and the general atmospheric pressure arrangements around Japan are diagrammatically represented.

3148 APTIC NUMBER 21052

Laykhtman (Leichtmann), D. L. and S. M. Ponomareva
ON THE RATIO OF THE TURBULENT TRANSFER COEFFICIENTS FOR HEAT AND MOMENTUM IN THE SURFACE LAYER OF THE ATMOSPHERE. Bull. Acad. Sci. USSR, Phys. Atmos. Oceans (English translation from Russian of: Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana), 5(12):719-722, Dec. 1969. 18 refs.

A method of calculating the ratio of the turbulent transfer coefficients of heat (KT/K) and momentum (K) in the surface layer of the atmosphere is proposed. The ratio between KT/K and z/L was determined on the basis of various experimental data. The calculations showed this ratio to increase up to 3 under conditions of instability, to fluctuate between 0.7 and 0.9 under stable conditions, and to be slightly below unity for near-neutral conditions. These results are in good agreement with existing published data. (Author abstract)

3149 APTIC NUMBER 21535

Leighton, Philip A.
REACTIONS OF SULFUR DIOXIDE. In: Photochemistry of Air Pollution. New York, Academic Press, 1961, Chapt. 9, p. 234-253.

Sulfur dioxide, alone or in the presence of oxygen, is slowly photolyzed when exposed to solar radiation. The photolysis of SO2 alone yields sulfur and sulfur trioxide, but in the presence of oxygen or air, no sulfur is formed. The only observed product in this case is sulfur trioxide, or if water is present, sulfuric acid. The photochemical reaction of SO2 with hydrocarbons is discussed as well as the photolysis of mixtures of SO2, nitric oxide-nitrogen dioxide, and hydrocarbons in air. All three of the photochemical reactions of sulfur dioxide lead to the formation of particulates. The chemical nature of some of the particulates has not been determined. Sulfur dioxide may play a large part in the photochemical

formation of aerosols in polluted air. Rates and equations for the various reactions are included.

3150 APTIC NUMBER 21619

Leighton, Philip A.
REACTIONS OF OXYGEN ATOMS. In: Photochemistry of Air Pollution. New York, Academic Press, 1961, Chapt. 5, p. 115-151

Only two reactions in polluted urban atmospheres are known to lead to oxygen atoms. These are the primary photochemical dissociations of nitrogen dioxide and of ozone. When oxygen atoms are formed in the presence of molecular oxygen, ozone is produced. The reaction of oxygen atoms with molecular oxygen sets an upper limit to the stationary concentration which these atoms will attain in polluted air. The reaction of oxygen atoms with ozone retards the photochemical synthesis of ozone from oxygen. Oxygen atoms appear to combine much more slowly in the gas phase than do other atoms. Small amounts of nitrous oxide are formed upon irradiation of a mixture of nitrogen and oxygen with light of wavelengths which are known to photo-dissociate the oxygen. Reactions of oxygen atoms with nitric oxide and nitrogen dioxide are discussed. In every case investigated, oxygen atoms reacted with hydrocarbons. Oxygen atoms react with aldehydes by abstracting the aldehyde hydrogen. Equations and rates for the various reactions are discussed.

3151 APTIC NUMBER 20591

Lenschow, Donald H. and Warren B. Johnson, Jr.
CONCURRENT AIRPLANE AND BALLOON MEASUREMENTS OF ATMOSPHERIC BOUNDARY-LAYER STRUCTURE OVER A FOREST. J. Appl. Meteorol., 7(1):79-89, Feb. 1968. 32 refs.

During three observational periods in the spring and summer of 1964, an experimental program was conducted over a forested area in northeastern Wisconsin in which airplane measurements in the planetary boundary layer were obtained in conjunction with simultaneous pilot-balloon observations of mean wind profiles up to a height of 2000 meters and supporting surface-layer measurements. A strong dependence of horizontal and vertical velocity variances upon stability was found, and velocity spectra for stable and unstable conditions were quite different. A clear distinction between the eddy sizes responsible for momentum transport in near-neutral and unstable situations was shown by the co-spectral densities of horizontal and vertical velocities. Heat-flux profiles derived from the combined data were qualitatively similar to those found by previous investigators and to Ball's theory, in that the heat flux decreases steadily with height and tends to become negative in the upper portion of the boundary layer. However, the eddy-energy budget failed to show the strong transport of eddy energy to the inversion level that is required by Ball's model, indicating that is such transport occurs, it must be at wavelengths longer than those measured. An approximate balance of the eddy-energy budget is possible when allowance is made for the bandwidth restrictions on the vertical flux measurements. (Author abstract)

3152 APTIC NUMBER 20397

Leone, Ida A., Eileen Brennan, and Robert H. Daines
DAILY FLUCTUATION OF PHYTOTOXIC AIR POLLUTANTS IN THREE NEW JERSEY COMMUNITIES AS INFLUENCED BY CERTAIN METEOROLOGICAL PARAMETERS. Plant Disease Reptr., 46(3):140-144, March 15, 1962. 20 refs.

Concentrations of sulfur dioxide, oxidant, and nitrogen dioxide were measured daily in three New Jersey farming communities during September and October 1960. Every time the oxidant content exceeded 0.045 ppm, there was an incidence of tobacco fleck. The extent of air pollution was evaluated in each community and the data plotted against three meteorological parameters: barometric pressure, wind speed, and visibility. Results showed a direct relationship of pollution load to barometric pressure, and an inverse relationship to wind speed and visibility. Data such as these may provide a basis for an air pollution forecasting system that would indicate the appropriate time for taking control measures. (Author summary modified)

3153 APTIC NUMBER 20993

Loosli, H. H., H. Oeschger, and W. Wiest
ARGON 37, ARGON 39, AND KRYPTON 81 IN THE ATMOSPHERE AND TRACER STUDIES BASED ON THESE ISOTOPES. J. Geophys. Res., 75(15):2895-2900, May 20, 1970. 17 refs.

Results of monthly air measurements on tropospheric samples of Ar (37) are tabulated and results of measurements of atmospheric activities of the recently detected isotopes Ar(39) and Kr(81) are discussed. The estimated average tropospheric production rates of Ar(37) are 0.0070 dpm/l and 0.0055 dmp/l for periods of mean solar activity and high solar activity, respectively. The average atmospheric production rate of Ar(39) is calculated as 0.10 dpm/l. The production rate Kr(81) is estimated to be either 0.014 plus or minus 0.003 dpm/l or 0.11 plus or minus 0.03 dpm/l. These global production estimates are not considered good enough for quantitative conclusions on cosmic ray constancy. If production rate values are to be improved, better particle flux measurements, cross section measurements, and model calculations are necessary. In addition to studying constancy of cosmic radiation, the potential applications of these noble gas isotopes include their use as tracers in studies of the atmosphere, oceans, and ground water and in age determination of ice layers.

3154 APTIC NUMBER 21599

Ludloff, Karl G.
SOLUTION OF DIFFUSION PROBLEMS. J. Appl. Phys., 39(8):3962-3967, July 1968. 2 refs.

In analogy to the kinematics of fluid mechanics, the principle of superposition of singularity solutions (sources, sinks,

doublets, etc.) is applied to the solution of diffusion problems. The two-dimensional, steady process of diffusion of contamination density q, under the combined influence of a wind velocity U(z) in the x direction and the diffusion transport in the z direction with eddy diffusivity K(z), leads to an equation with parabolic character. This is in contrast to the elliptic (or hyperbolic) character of the equations of fluid mechanics. Therefore, the fundamental concepts, like source, doublet, streamline, line of constant contamination, have to be rederived and illustrated. Since the singularity solutions must fulfill specific boundary conditions, linear combinations of these solution were obtained by multiplying them with appropriate weight function f(zeta), and integrating them over a given zeta range.

3155 APTIC NUMBER 21131

Ludwig, John H.
AIR QUALITY CONSERVATION -- THE NEED IS NOW. Preprint, American Meteorological Society, Boston, Mass., 8p., 1969. 11 refs. (Presented at the Symposium American Meteorological Society on the Future of the Atmosphere, Madison, Wis., Oct. 22, 1969.

Increased global carbon dioxide and particulate concentrations are viewed in the context of their potential effects on world temperature and climate. Past considerations of the global effects of widespread air pollution have been mostly qualitative and speculative, and even today there are insufficient means for scientists to pinpoint the cause of indicated changes in man or his environment. Extensive measurements and research are needed to test the various hypotheses concerning man's influence on his environment and vice versa. With this in mind, the National Air Pollution Control Administration is conducting a critical review of the current state of knowledge and of efforts to describe the long-term geophysical and biological effects of global atmospheric pollution. The scientific evidence obtained of the need for control will be systematically linked to control efforts.

3156 APTIC NUMBER 20344

Munn, R. E.
AIR POLLUTION METEOROLOGY. Occupational Health Rev., (Ottawa), 20(3-4):1-8, 1968-1969. 10 refs.

There is a trend toward basing legislation on air quality criteria on weather factors as well as on source strength. The governing meteorological variables in air pollution are wind (both direction and speed), turbulence, and precipitation. Stronger winds produce more dilution. If regional winds remain light for several days, horizontal ventilation is absent and pollution accumulates. The wind stretches the smoke or gas emitted from a chimney and carries the pollutants downwind. The distance that pollutants can travel is not always appreciated, but large-scale transport of significant amounts of pollutants from city to city is not impossible on occasions. A plume of smoke also expands in the vertical and cross-wind directions. Very large fluctuations of the wind moves the total plume, causing it to meander from side to side but not producing any turbulence. Very small fluctuations are relatively inefficient in the expansion process. The major contribution to diffusion is made by wind gusts and lulls of about the same size as the plume diameter. The diffusion process is enhanced by superadiabatic lapse rate. Inversions dampen turbulent fluctuations and reduce diffusion rates. Precipitation washes out pollution but quantitative figures on the magnitude of the effect are difficult to obtain. However, even when air quality improves due to rain, down-wash behind buildings can be a source of pollution if winds are strong.

3157 APTIC NUMBER 20627

Nakano, M. and T. Narukawa
ANALYSIS OF HEAVY ATMOSPHERIC POLLUTION. (Konodo osen no kisho kaiseki). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):12, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

When the influence of gradient wind is small in Osaka, around 10-11 am with the early morning easterly land wind shifting into the westerly patter, dense smog covers the central area. When the westerly sea breeze starts blowing in the afternoon, the pollution spreads out eastward, and the concentration becomes low. The pollution becomes a problem when the concentration is high throughout the daytime. Heavy pollution is usually limited to days with little wind, and meteorological data for smog warning days between 1965 and 1969 were analyzed to see under what atmospheric pressure arrangement in conjunction with the local wind pattern the high concentration occurs. In addition, checksheets were drawn up to find the general atmospheric pattern that would serve as a key to forecasting severe pollution a day earlier.

3158 APTIC NUMBER 21413

Neiburger, Morris
METEOROLOGICAL ASPECTS OF AIR POLLUTION. Arch. Environ. Health, vol. 14:41-45, Jan. 1967. (Presented at the AMA Air Pollution Medical Research Conference, 8th Annual, Los Angeles, Calif., March 2-4, 1966.)

The meteorological aspects of air pollution are reviewed as a background for the implications they have on biological and medical effects. Wind velocity is a transport and diffusion factor. Temperature gradient controls the up and down movement of air. Inversions account for many of the air pollution episodes, and can occur as a result of stagnating anticyclones. London-type smog is accompanied by low temperatures and high humidities. The Los Angeles-type normally has high temperatures, and the relatively humidity drops to a very low values during the day. Pollutants in particulate form can act as condensation nuclei and get washed out during a rain. Pollution effects depend upon point or area sources and the meteorological factors. Solar radiation is important in oxidation-type smog.

3159 APTIC NUMBER 20977

Nickola, P. W.
RESULTS OF FIELD INVESTIGATIONS OF THE EFFECT OF SOURCE HEIGHT AND STABILITY ON ATMOSPHERIC EXPOSURE. In: Pacific Northwest Laboratory Annual Report for 1968 to the USAEC Division of Biology and Medicine Vol. II: Physical Sciences Part I. Atmospheric Sciences. Battelle-Northwest, Richland Wash., Pacific Northwest Lab., p. 1-4, Nov. 1969. 1 ref.
CFSTI: BNWL-1051

A series of field tracer releases was conducted during stable atmospheric conditions. The tracer release height was 85 ft. Tracer sampling occurred at an elevation of 5 ft above ground level at distances between 0.8 and 12.8 km. Results from these field tests are presented in the form of normalized tracer exposures versus travel time for several thermal stratifications of the atmosphere. These results are compared with similar results from releases at elevations of 23 and 185 ft. The travel time required to reach the maximum ground level centerline exposure increases with increasing stability and increasing release height. (Author abstract modified)

3160 APTIC NUMBER 20688

Odaira, T. and S. Fukuoka
RELATION BETWEEN SULFUR DIOXIDE CONCENTRATION AND METEOROLOGICAL CONDITION AT VARIOUS HEIGHT ON THE TOKYO TOWER. (Tokyo tawa ni okeru kodobetsu aryusangasu nodo to kishojoken to no kankei ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):9, 1969. (Proceedings of the 10th Annual Meeting of the Japan Soceity of Air Pollution, 1969.)

The relationship between the concentration of sulfur dioxide in air and the meteorological conditions for Tokyo in spring was investigated based on the stereo-measurement data from Tokyo Tower. The tabulation of the results demonstrates that the average monthly concentration of sulfur dioxide at higher altitudes, e.g. at 125 m, is about three times that of the 25 m altitude. The examination of concentrations in relation to wind direction and velocity shows that the concentration is high for southerly winds at 125 and 225 m, and the frequency of high concentration (frequency of 0.2 ppm or more/ frequency of a wind direction) is highest at 125 m and 225 m with the SW and S-SSW wind components; northerly winds have little influence. While concentration declines with the increase in the velocity of northerly winds, it is not always the case for southerly winds. It can be concluded that in spring, high concentration of sulfur dioxide is flowing over the central part of Tokyo at the altitudes of 100 to 250 m.

3161 APTIC NUMBER 21154

Oke, T. R.
TOWARDS A MORE RATIONAL UNDERSTANDING OF THE URBAN HEAT ISLAND. Climatol. Bull (McGill Univ.), no. 5:20p., Jan. 1969. 31 refs.

The five classes of factors controlling the urban climate and hence the urban heat island are reviewed, and the inadequacies of methods of investigating the fundamental mechanisms of the heat island are discussed. The unique properties of the urban environment are the urban fabric, city structure, artificial heat production, urban water balance, and urban air pollution. Urban construction materials give the city a drier, denser, less previous, and more rigid surface than that of the countryside. The configuration of buildings tends to trap radiation within the city and reduce turbulent transport at street level, even though the city presents a rough surface to airflow above buildings. A general lack of naturally transpiring surfaces in a city may result in decreased evaporation. Climatically, air pollution modifies component fluxes in the radiation balance. Heat island studies based on isotherm maps of temperature distribution are largely descriptive and do not identify which controlling factor is largely responsible for the observed form of the heat island. To understand the processes producing or destroying a heat island, it has been suggested that more attention be focused on the way heat is utilized in the urban environment. However, the complexity of the city's surface makes it impossible to implement the heat balance approach by methods, such as the Bowen ratio and aerodynamic methods, employed to study heat balance in the country. The infrared flux divergence approach may represent a way to arrive at conclusions concerning the processes responsible for warming the urban atmosphere, without the necessity of making specific reference to the surface itself. This approach assumes that air temperatures are determined by both turbulent and radiative heat transfer. It is proposed to test the hypothesis by direct observations.

3162 APTIC NUMBER 20762

Pannetier, R.
ORIGINAL USE OF THE RADIOACTIVE TRACER GAS KRYPTON 85 TO STUDY THE MERIDIAN ATMOSPHERIC FLOW. J. Geophys. Res., 75(15):2985-2989, May 20, 1970. 11 refs.

The radioactive atmospheric tracers most commonly used are aerosols. Because aerosols have a tropospheric lifetime of the order of a month, they are unsuitable for the study of longer lasting phenomena such as the meridian flow of the troposphere and yearly tropospheric exchanges between hemispheres. Krypton 85 can be used as tropospheric tracer to estimate the annual exchange across the substropical fronts. These exchanges are estimated at .2 to .3 of the total atmosphere of the north front, and .15 to .25 of the south front. These first numerical estimates of transfer can be improved by extending the monitoring network of krypton 85 concentration. Krypton 85 originates mainly from the continuous, ever-increasing wastes from fuel reprocessing plants, almost all of which are located in the zone 45 deg to 55 deg N. The amount released by nuclear explosions will be negligible in a few years, and this will simplify the interpretation of worldwide distribution. (Author conclusions modified)

3163 APTIC NUMBER 21684

Parungo, Farn P. and J. Owen Rhea
LEAD MEASUREMENT IN URBAN AIR AS IT RELATES TO WEATHER MODIFICATION. J. Appl. Meteorol., 9(3)468-475, June 1970. 8 refs.

Results from measurements made to study the behavior of lead aerosols in Denver urban air as latent ice nuclei are discussed. In the study, use was made of three independent measuring systems: 1) an NCAR continuous ice nucleus counter with a capacity to convert suspended lead compounds to lead iodide particles prior to passage through the cloud chamber and counting unit, 2) an atomic absorption spectrophotometer for analysis of lead content in collected air and rain water samples, and 3) the use of Tufts' spot test for obtaining lead particle concentration and size distribution from collected Millipore filters. Both ground and airborne measurements were made. Pertinent findings included: 1) good qualitative agreement among the three types of measurements; 2) lead content of rain water an order of magnitude greater than silver concentration in seeded snow samples which were collected in a weather modification seeding target area using silver iodide as the seeding agent; and 3) 10-300 lead particles (latent ice nuclei)/liter existing up to 9000 ft above the surface when unstable temperature stratification existed and which were converted into active ice nuclei (lead iodide particles) when passed through an iodine vapor chamber. (Author abstract)

3164 APTIC NUMBER 21073

Peterson, Kendall R.
CONTINUOUS POINT SOURCE PLUME BEHAVIOR OUT TO 160 MILES. J. Appl. Meteorol., vol. 7:217-226, April 1968. 8 refs.

In order to study the behavior of the plume emitted from the air-cooled nuclear at Brookhaven National Laboratory on central Long Island, N. Y., radioactive argon-41 was measured by an airborne gamma-ray spectrometer as far as 160 naut mi downward on a day with neutral stability. A vertical cross-section at 144 naut mi obtained by a vertical 'saw-tooth' sampling technique, showed the plume to be well organized with a nearly uniform vertical distribution to at least 2000 ft. The peak concentration, when corrected for radioactive decay, decease by about a factor of 7-10 over a distance of 150 naut mi and a travel time of 10-12 hr. The lateral standard deviation of the plume appeared to fit an extension of the Pasquill-Gifford "D" curve with distance, where the plume, in naut mi is approximately equal to two-thirds of the travel time in hours. The usefulness of a vertical saw-tooth flight path was verified and is believed to be superior to a series of horizontal passes perpendicular to the plume. (Author abstract modified)

3165 APTIC NUMBER 20532

Priestley, C. H. B.
HANDOVER IN SCALE OF THE FLUXES OF MOMENTUM, HEAT, ETC. IN THE ATMOSPHERIC BOUNDARY LAYER. Phys. Fluids, 10(9):S538-S546, Sept. 1967. 23 refs.

The handover of the vertical fluxes from the small-scale turbulence close to the earth's surface into the larger-scale motions above is examined in the context of numerical treatment of atmospheric dynamics, and the need is defined for a clearer identification of the typical acceleration patterns and for numerical solutions of the appropriately modified boundary layer equations. In convective conditions, a decoupling of heat flow from the surface value is suggested at a height of some 5 to 10 times the Obukhov scale height and at times lower; but above it, the need for direct measurement of the eddy heat flux on the cumulus scale, and location of the roots of these circulations, is emphasized. For momentum flux, the handover from microscale direct into the synoptic scale is primarily considered. At a level where the microscale flux has fallen from its surface value, the vertical motion in unaccelerated flow is: equivalent to curl ((surface drag-microscale flux of momentum)/f), where f is the Coriolis parameter. When this is viewed as a component of eddy motion on the global scale, the resultant eddy transport of momentum is insignificant, but the asymmetry of acceleration patterns in the westerlies, particularly that broadly associated with the transient frontal systems, appears to yield significant momentum flux in the required direction. The momentum flux attributable to thermal wind and the handover into mean meridional circulation are also discussed. (Author abstract modified)

3166 APTIC NUMBER 21129

Ramsdell, J. V., Jr. and W. T. Hinds
PEAK-TO-MEAN CONCENTRATION RATIOS AS A FUNCTION OF CROSSWIND POSITION WITHIN THE MEAN PLUME AND THE RATIO OF THE DURATION OF THE MEAN TO DURATION OF THE PEAK. In: Pacific Northwest Laboratory Annual Report for 1968 to the USAEC Division of Biology and Medicine Vol. II: Physical Sciences Part I. Atmospheric Sciences. Battelle-Northwest, Richland, Wash., Pacific Northwest Lab., p. 5-13, Nov. 1969. 8 refs.
CFSTI: BNWL-1051

Diffusion data obtained from four short duration continuous releases of (85)Kr were analyzed to examine concentration fluctuations at various positions on a fixed sampling grid. Following a discussion of the effects of atmospheric stability and distance from the source on concentration fluctuations, a detailed study was made of the magnitude of the fluctuations as a function of crosswind position within the mean plume, and the ratio of the duration of the mean concentration to that of the fluctuation (time ratio). In particular, peak-to-mean concentrations were an exponential function of the normalized crosswind position within the mean plume. A single power law was inadequate to fully describe the relationship between peak-to-mean ratios and the time ratio; however, at time ratios greater than 4, the experimental relationship followed an approximate power law. The data suggest that peak-to-mean ratios estimated for positions near the mean centerline in previous studies are significant underestimates. A working model for estimating peak-to-mean concentration ratios which combines the exponential and power law relationships is given.

3167 APTIC NUMBER 21122

Peidat, Rudolf
FINDINGS ON THE VARIATION OF UNSTABLE WEATHER CONDITIONS IN THE LOWER PORTION OF THE ATMOSPHERE FROM TEMPERATURE RECORDINGS UP TO A HEIGHT OF 200 METERS AND THEIR APPLICATION IN SUPERVISING THE HAMBURG INDUSTRY. (Erkenntnisse ueber den gang der Instabilitaet der unteren Atmosphaere aus temperaturregisterierungen bisweihundert Mete Hoehe and inhre Anwendung bei der Beratung der Hamberg Indstrie. Inst. Gewerbliche Wasserwirtschaft Luftrein Halting Forum, vol. 6:41-58, 1967. 2 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 20p., Sept. 22, 1969.

The frequency and duration of stable air masses up to 500 m was determined from data obtained during weather observation flights between 1933 and 1948 before the construction of a large power plant near Stade. To determine how stack height would affect mixing in the immediate vicinity of the plant, temperature lapse rates were monitored up to 200 m. On a yearly average, 167 days with surface inversions were counted, one fourth of which reached a height of 200 m and one fourth, a height of more than 350 m. Seven eighths of these temperature inversions disappeared by afternoon. The days on which no mixing occurred averaged about 44 a year. Only one fourth of the stable weather conditions lasted longer than four days. The longest stable conditions prevailed in December. Analysis of the temperature lapse rates showed that half of the hours between midnight and sunrise are marked by temperature inversions which extend to 175 m. No inversions were recorded between noon and 2 P.M. It is concluded that high stacks reaching higher than surface haze emit smoke in a coning plume until midnight, after which stabilizing upper layers change the smoke plume to a fanning one. A special weather service is suggested to guard against emissions during stable conditions.

3168 APTIC NUMBER 21044

Peiter, H. and P. Sladkovic
CONTROL OF VERTICAL TRANSPORT OF AEROSOLS BETWEEN 700 AND 3000 METERS BY LAPSE RATE AND FINE STRUCTURE OF TEMPERATURE. J. Geophys. Res., 75(15):3065-3075, May 20, 1970. 11 refs.

The vertical-mass-exchange coefficient was determined from aerosol measurement by two independent methods over a considerable period of time. Well-substantiated relationships between the exhange coefficient and meteorological parameters existed in the lower troposphere between 700 and 1800 meters. The first of the two methods consisted of measuring RaB concentration in air at 700, 1800, and 3000 meters; the second was soundings of total air conductivity between 700 and 1800 meters. In the first method, mean exchange coefficients were computed from RaB concentration gradients. In the second, the air conductivity data were used to compute particle concentration profiles, from which incremental exchange coefficients can be computed for thin-layer increments. The mean exchange coefficient for the 700- to 1800- and the 1800- to 3000-meter layer was a function of the average temperature lapse rate in the respective layer. The exchange coefficient of an inversion layer is a function of the greatest inverse lapse rate existing in any part of the inversion. Vertical aerosol transport through a layer of any thickness is primarily determined by the lowest incremental mass-exchange coefficient of any thinner layer contained therein. (Author abstract)

3169 APTIC NUMBER 21115

Riehl, Herbert and Loren W. Crow
A STUDY OF DENVER AIR POLLUTION. Colorado State Univ., Fort Collins, Colo., Dept. of Atmospheric Science, TR-33, 15p., June 1962.

Wind direction, wind speed, and temperature were observed during five pollution episodes at five special project stations, taken in conjunction with six additional stations, and observations were supplemented by ground and aerial photography, visual observations, and measurements of sunlight intensity. An air sampling program was conducted by the City of Denver during the four pollution episodes in 1962; the total weight of particulate matter, collected in high-volume samplers over 24 hours, was determined at three stations. Mean pollution intensity increases by a factor of five from south to north across the city. Pollution rises sharply during each morning with onset of daily business activity, decreases with warming and increasing vertical motion of air, and increases again with lowering temperatures in the afternoon. Photographic success was due entirely to the fact that the polluted air mass maintained a rather sharp edge, especially along the southern boundary, while maintenance of the polluted mass as a body indicates that the daily course of pollution in bulk is not governed by small-scale lateral diffusion but by the air circulation on the scale of the whole city or larger. Trajectories of actual paths of air movement across the city were made and related to local topography.

3170 APTIC NUMBER 20784

Rodhe, Henning
ON THE RESIDENCE TIME OF ANTHROPOGENIC SULFUR IN THE ATMOSPHERE. Tellus (Uppsala), 22(1):137-139, 1970. 3 refs.

In considering the circulation of sulfur and other compounds in the atmosphere, especially in connection with dispersion from an anthropogenic source, it is important to know the residence time of the compound in the atmosphere. The time varies considerably from one source to another, depending on the way the emission takes place and on meteorological factors. Snow samples were collected with an aluminium spade from the center of Uppsala to a distance of 15 km from the center of town. Winds during the period were slight to moderate; the total amount of precipitation was about 20 mm. The amount of sulfur emitted was approximately 240 tons, one-third of which came from a power station. When defined as the distance within which two-thirds of the emitted amount was deposited, divided by the mean transport velocity, the residence time of sulfur was found to be greater than or approximately three hours. When the background value of sulfur was substracted from the accumulated deposition, the residence time was greater than or approximately five hours. It is

suggested that more detailed investigations of this type be carried out to estimate the strength of sink mechanisms for anthropogenic sulfur and other compounds.

3171 APTIC NUMBER 20996

Roedel, Walter
COSMIC-RAY-PRODUCED SODIUM 24 AND OTHER NUCLIDES IN THE LOWER ATMOSPHERE. J. Geophys. Res., 75(15):3033-3038, May 20, 1970. 18 refs.

The concentration of cosmic-ray-produced Sodium (24)(15) hours/half-life) in the lower atmosphere was calculated and measured, and the production rate of this nuclide was estimated. The distribution of the specific activity was calculated for different sets of vertical eddy diffusion parameters. The concentration of Sodium(24) in the lower layers of the troposphere is sensitive to vertical eddy diffusion coefficients in the range of about 50,000 to about 1,000,000 sq cm/sec; at altitudes above 4 or 5 km, the sensitivity of the Sodium(24) concentration to eddy diffusion strength decreases. Several measurements of Sodium(24), Sodium(22), and Beryllium(7) in ground-level air were carried out. Some measurements of Sodium(24) in rain-water samples were carried out. Measurements suggest that short-lived cosmic-ray-produced nuclides are useful as tracers for atmospheric motions for a wide range of eddy diffusion parameters in the lowest 4 or 5 km of the troposphere. (Author abstract modified)

3172 APTIC NUMBER 20987

Rosen, James M.
THE VERTICAL DISTRIBUTION OF PARTICULATE MATTER NEAR THE SURFACE OF THE EARTH. Minnesota Univ. Minneapolis, School of Physics and Astronomy, ONR Contract N00014-67-A-0113-0004, Rept. AP-29, 11p., Oct. 1969. 2 refs.
CSFTI, DDC: AD 696541

Several balloon soundings from the Minneapolis and St. Paul area did not add considerably to the understanding of atmospheric mixing processes already known, but the profiles obtained illustrated in a quantitative fashion the dependence of dust concentration on the temperature structure, relative humidity, and wind velocity. A photelectric aerosol counter, utilizing two independent scattered ligth detectors rather than one, was the instrument employed. Polluted air from the surface of the earth can be mixed upwards to the temperature inversion, but will not cross it; hence, there is a large drop in aerosol concentration across the inversion. Dust concentration above the inversion and in the upper troposhere is prevented from building up by the natural cleaning process brought about with the production of clouds and rain. The region below the temperature inversion at 700 mb is sometimes referred to as the exchange layer and is almost always present under fair weather conditions between 1000 and 10,000 ft. The wind velocity profile shows a gradual increase in wind speed up to the inversion, and the exchange layer appears to be a form of frictional boundary between the surface of the earth and the atmosphere. While the inversion next to the earth's surface is developing, the air temperature is dropping, causing a corresponding increase in relative humidity, which in turn can cause a growth in particle size. The relative humidity, dust concentration, and size distribution seem to be all positively correlated in the first 10,000 ft.

3173 APTIC NUMBER 21128

Schmel, G. A. and L. C. Schwendiman
PARTICLE DEPOSITION FROM TURBULENT FLOW. In: Pacific Northwest Laboratory Annual Report for 1968 to the USAEC Division of Biology and Medicine Vol. II: Physical Sciences Part I. Atmospheric Sciences. Battelle-Northwest, Richland, Wash., Pacific Northwest Lab., p. 52-58, Nov. 1969. 15 refs.
CFSTI: PNWL-1051

A theoretical model was investigated to describe turbulent deposition of particles onto surfaces. Particle transport to the deposition surface is described by particle eddy diffusivities. Two innovations from published deposition models are incorporated into the new model. The first of these is the discarding of the concept that the particle is finally brought to the surface by 'free-flight' due to its inertia. The second is that particle eddy diffusivities are not the same as eddy diffusivities for air momentum as is generally assumed. In this study, the particle eddy diffusivities are back calculated from the deposition data. From these calculations, it is concluded that particle turbulent diffusivities are greater than those for air momentum transfer in turbulent flow. The general range of these particle eddy diffusivities was determined. A full understanding of the parameters controlling the deposition of fine particulate matter would permit calculation of particle losses to the wall of ducts and sampling lines, and would clarify the significance of rebounding and re-entrainment of particles in a variety of situations.

3174 APTIC NUMBER 20928

Selickaja, V. I.
AN ANALYSIS OF THE AEROLOGICAL CONDITIONS FOR ATMOSPHERIC POLLUTION IN SOME REGIONS OF THE EUROPEAN U. S. S. R. Tr. Gl. Geofiz. Observ. (Leningrad), vol. 207:188-201, 1968. 5 refs. Translated from Russian by C. Long, Meteorological Office, London, England, 11p.

Meteorological observations being carried out in the lowest 500 m of the atmosphere for studies of interaction with air pollution are reported for three power station sites in the Moldavin, Cerepet, and Scetino regions of the European U. S. S. R. The data include mean values of air temperature, lapse rate, relative and specific humidity, and wind speed. Summary analyses of the data are presented, as well as notes on cloud cover. Measurements were made by balloon sounding. Considerable diurnal variation of all meteorological parameters was noted; it is therefore recommended that the number of night ascents be increased to allow more detailed study of the thickness and intensity of inversion layers which create hazards for surface layer pollution.

3175 APTIC NUMBER 21281

Shah, G. M.
STUDY OF AEROSOLS IN THE ATMOSPHERE BY TWILIGHT SCATTERING.
Tellus (Uppsala), 22(1):82-93, 1970. 11 refs.

The feasibility of the twilight scattering method for measuring vertical distributions of dust particles was investigated photometrically in twilight intensity measurements at Mt. Abut, India (24 deg N and 4000 ft above sea level) during 1957-1959. A twilight photometer was used in conjunction with a telescope of small aperture and a color filter transmitting in red (centered at 6000 A). The telescope of the photometer was kept at a fixed altitude (70 deg from zenith) and sunset (sunrise) azimuth. The results show that as the sun sinks below the horizon, the effective height of the earth's shadow rises and light scattering takes place from higher and higher levels. Most of the light received at the ground will be the primary scattered light by the particles (molecular plus large particles) for solar depressions less than 6-7 deg. At Abut, the maximum particle concentrations occur, on the average, at about 20 km; these are associated with maxima on the logarithmic gradient of intensity. The lowest average height of about 14 km was found in June and the highest (23 km) was found in November-December. The measurements confirm the existence of a stratospheric dust layer at around 20 km.

3176 APTIC NUMBER 21148

Starkova, Bela
PRODUCTION OF TEST AEROSOLS BY VAPOR CONDENSATION IN TURBULENT GAS MIXING. Staub (English translation from German of: Staub, Einhaltung Luft), 29(10):27-31, Oct. 1969. 8 refs.

Polydisperse systems in which vapor condensation on mixing of two air streams differing in temperature and vapor concentration plays a part were studied to determine the influence of the following parameters on particle size and distribution: the presence of condensation nuclei; the concentration or supersaturation of the vapor; the type of cooling and rarefaction of all the components of the system. Diphenyl and cinnamic acid aerosols were formed by condensation on their own seeds or foreign nuclei (NaCl) upon turbulent mixing of hot air saturated with vapors of the compounds and cold air. Regression analysis shows, that the most important parameters for the formation of particles can be controlled, especially air quantity at the temperature serving for rarefaction and cooling, and the temperature gradient between the temperature of the heater and that of the resulting air stream with the particles. These factors are responsible for 74-89% of all effects determining the final result, which must be carefully controlled and maintained at constant values.

3177 APTIC NUMBER 21155

Super, Arlin B., Robert B. Yaw, and Angelito B. Sandoval
ATMOSPHERIC WATER RESOURCES PROGRAM. (FINAL REPORT). Montana State Univ., Bozeman, Dept. of Earth Sciences, Bureau of Reclamation Contract 14-06-D-6144, 68p., June 30, 1969. 16 refs.
CFSTI: PB 186122

During the winter of 1968-69, a randomized seeding program was conducted in the Bridger Mountains north of Bozeman, Montana. A population of operational days was selected by the probability of precipitation as determined by the U. S. Weather Bureau Airport Station at Helena, Montana, and by the measured 700 mb wind at Great Falls, Montana. From this population, seeding days were determined by random selection. Silver iodide generators were ground based and of the Colorado State Univ. type. The intent of the project was to seed air moving over the orographic barrier of the Bridger Mountain Range and determine the effectiveness of the seeding in a target area downstream on the slopes of the Bangtail Mountains. Precipitation measurements were made with a network of 22 high resolution weighing gauges. Temperature, moisture, winds, and ice nuclei were measured at the Bangtail Mountain Observatory in the target area. A thermograph network on the western slopes of the Bridger Range provided information concerning temperature distribution and stability; upper air data from the radiosondes released from the Bozeman campus and from the Great Falls Weather Bureau Station were used. Aircraft measurements of ice nuclei were made on two occasions and snow samples were collected at the end of the winter season for silver analysis. Late in the winter season, a program of data collection using radar was implemented and techniques for quantitative measurement of precipitation were developed. Precipitation data were analyzed by three methods: (1) a target-control method which involved the normalization of the precipitation data prior to use; (2) factor analysis; and (3) eigenvector analysis. The target-control method indicated no significant effect when interpreted in the light of the physical aspects of the experiment. While the factor analysis originated factors which may have physical interpretations, no conclusions concerning seeding effects were apparent in the more significant factors. Eigenvector analysis was largely inconclusive. It must be concluded that there is no reasonable indication of any significant effect resulting from seeding during the past winter. This is probably due, at least partially, to the frequent presence of inversions above the silver iodide generators. (Author abstract)

3178 APTIC NUMBER 20331

Suzuki, Shin
CHEMISTRY OF AIR POLLUTION. II SCATTERING OF SOLAR LIGHT IN THE ATMOSPHERE. (Taikiosen no kagakuhanno. II Taikichu niokeru taiyoko no kakusan). Text in Japanese. Kagaku Kogyo (Tokyo), 21(3):393-401, March 1, 1970. 15 refs.

Leighton's data on photochemistry of air pollution is employed to discuss the problem of diffusion of solar rays. The solar spectrum in outer space shows that the maximum intensity of sun light is 4500 A and the peak of photon numbers is 6000 A. Variations in the photon numbers are the source of the diffusion problems. The words air mass and solar zenith angle are introduced before the argument. The Bouguer-Lambert formula describes the intensity of light before the polluted sphere and

shows that the attenuation coefficient is the sum of effects of molecular scattering, particulate diffusion, and absorption coefficient. The molecular scattering term, which is calculated from Rayleigh's formula, decreases to the fourth power with increasing light wavelength. Mie's scattering theory is used for the theoretical treatment of particulate diffusion, but the experimental formula adopted in practice does not include many complicating factors: particulate diffusion equals b times wavelength to the minus nth power, where b is the function of particulate numbers and n is the particle diameter. Rayleigh's law is used to describe diffusion of particulates less than 0.1 to approximately 0.05 micron in diameter, but n decreases from 4 to 0 with the increasing particle diameter. The most important factors of light absorption by atmosphere are that by the ozonic sphere and the oxygen sphere. Vapor and carbon dioxide gas also cause the absorption of light. Huggins' aborption zone and Chappuis' absorption zone are recognized as the absorption of ozonic sphere, which make the refraction of sunlight weak. The concept of 'direct radiation' and 'sky radiation' is the point of the light concerning photochemical reaction. The shorter the wavelength of light and the larger the solar zenith angle, the stronger the intensity of sky radiation in contract to the intensity of direct radiation. The absorption of light by photochemical reaction in a polluted sphere is calculated by Lambert-Beer's law, and the specific absorption rate is defined.

3179 APTIC NUMBER 21325

Suzuki, Shin
CHEMISTRY OF AIR POLLUTION. IV. SUCCESSIVE REACTIONS OF AIR PHOTOCHEMICAL REACTION. (Taiki osen no kagaku hanno. IV. Taiki kokagaku hanno no kozoku hanno). Text in Japanese. Kagaku Kogyo (Tokyo), 21(6):787-792, June 1, 1970.

From the view point of air pollution, the importance of successive reactions which occur after photchemical reaction in air are determined by the reaction rate. The relatively important reactions of several gases are discussed. The greater part of oxygen in the air is in the 3P state (99.7%) and reacts with O2 to produce O3. The mechanism of this reaction which is thought to be trimolecular, is stated in detail. In this reaction, the activation energy is minus because of the three-step reaction mechanism. The next important reaction of O is with olefins. Reactions with nitric oxide and nitrogen dioxide are also important, and their mechanisms are also described in detail. The photolysis of NO2 is touched on. Little is known about the behavior of O in the 1D state: reactions with O2, CO, and H2O are considered. The calculated concentration of O in the air is very low compared with other substances. As for O3, its reaction with NO is a very rapid and second-order one. The next important reaction of O3 (except that with olefins) is the reaction with NO2, and this is considered to be bimolecular. Reactions between O3 and CO or SO2 may occur. Reactions leading to NO or NO2 are noted. In addition to the reactions mentioned above, there are other important reactions involving NO and NO2. Rate constants are given for some of the reactions described.

3180 APTIC NUMBER 21326

Suzuki, Shin
CHEMISTRY OF AIR POLLUTION. III. INITIAL PROCESS OF AIR PHOTOCHEMICAL REACTION. (Taiki osen kagaku hanno. III. Taiki kokagaku hanno no shoki katei). Text in Japanese. Kagaku Kogyo (Tokyo), 21(5):665-678, May 1, 1970.

Reactions of pollutant particles with sunlight are reviewed. Chemical reactions of particles in air begin mainly with the absorption of light. Nitrogen dioxide has the highest light absorption ratio, and it is widely regarded as photochemical matter. Following their excitation after light absorption, particles decompose or, possibly, collide with other particles. While oxygen is an important substance because of its high concentration, its photolysis is not a problem; its absorbing zone is smaller than the ultraviolet area of earth's surface sunlight. The allowed transition of oxygen, less than 1950 A, is important, since it produces oxygen atoms that may cause ozone. Dissociation of ozone is followed by visible or ultraviolet light. The forbidden transition of oxygen gives a small absorption coefficient. Unlike nitrogen dioxide, nitrogen oxide cannot be excited by sunlight. Fluorescence and photolysis are observed in nitrogen dioxide, the former being more than 3660 A and the latter, less than 4047 A. The dissociation energy of nitrogen dioxide is estimated to be 71-72 K cal/mole. A shortage of light energy is compensated for by thermal energy. The rate of photolysis producing nitrogen oxide is very large compared to other reactions. The transition from two-state, excited sulfur dioxide shows two different types of fluorescence: the magnetic field effect and the Stern-Volmer phenomena. Sunlight is required for the production of sulfur or sulfur monoxide but sunlight does not readily decompose sulfur or sulfur trioxide vapors to nitrogen dioxide. Alkyl nitrate photolysis yields many kinds of products due to the formation of nitrogen dioxide or aldehyde by its successive reaction, and is sensitive to light. The absorption spectrum of nitrous acid is less than 3850 A and is similar to that of alkyl nitrite. The photochemistry of nitrous acid is not yet clearly understood. Aldehydes and ketones are other observed air pollutants. Their absorption can also be followed by wavelength measurements, despite the interference of radicals. The absorption areas (2200-3400 A) partly contains the sunlight wavelength, but absorption coefficients are small.

3181 APTIC NUMBER 20351

Takamatsu, T., M. Naito, Y. Ikeda, and K. Kawata
CALCULATION OF PREDICTION FOR POLLUTANT CONCENTRATION. (Taiki osen nodo yosoku keisan moderu no kosatsu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):15, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

By electronic computer analysis of data on pollutant concentrations and meteorological conditions obtained by telemetry, a differential equation and its various solutions was developed in order to calculate and predict the pollution concentration by time and location. The first-order differential equation is essentially an

adjustment type equation where the time rate of change of concentration is specified within an atmospheric volume (zone) V. The equation depends on the parameter of vertical mixing, the concentration in question, the concentration of pollutants from the region outside V, the strength of emission in the zone, the station number, and the rate of diffusion of pollutants. Some of the parameters are determined from meteorological data, and the others implicitly from a combination of data. Based on the actual density of pollution (sulfur component) at 20 and 110 meter altitudes on Osaka Tower, it was suspected that in the immediate neighborhood of the tower, the ground level pollution is always concentrated in winter and that the effect of the localized surface emission sources is large. The result of the calculation tended to confirm the suspicion.

3182 APTIC NUMBER 20629

Takamatsu, T., M. Naito, Y. Ikeda, and K. Kawada
CONTROL FOR AIR POLLUTION. (Taiki osen seigyo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):16, 1969. 2 refs. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

By using a mathematical model that describes the atmospheric pollution concentration in a metropolitan area, the concentration a few hours away can be predicted when there is a continuous influx of data from the monitoring stations; control methods for pollution phenomena that contain too many uncertain elements can be probabilistically determined. The mathematical model is essentially a first-order differential equation that is described by vector and matrix notations, since the metropolitan area can be divided into N zones over a discrete time period k. By employing stochastic methods and optimality calculations, the desired results, the expected value of the concentration S hours away and the optimal control variable at zone i and time k, can be determined.

3183 APTIC NUMBER 20269

Takeda, M., S. Konno, and M. Moriguchi
A STATISTICAL ANALYSIS OF AIR POLLUTION IN METROPOLITAN AREA BASED ON A SIMPLIFIED DIFFUSION MODEL. (Kantan na kakusan moderu o riyo shita taiki osen no tokeikaiseki). Text in Japanese. Taiki Osen Kenky (J. Japan Soc. Air Pollution), 4(1):98, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

In the United States, the possibility of forecasting metropolitan air pollution by means of the diffusion model suggested by Miller and Holzworth is seriously being considered. In Japan, the Meteorological Agency is running a partial calculation by the same method. By modifying the models to a certain extent and employing the relationship between the down-wind distance and sigma-z obtained from the Pasquill-Gifford diagram, at certain time intervals in July and Dec. 1967, the average concentration of a metropolitan area was calculated and compared to the actual measurement observed in the Tokyo Metropolitan Area. The pollutants under consideration were sulfur oxides, nitric oxide, nitrogen dioxide, carbon monoxide, and suspended soot and dust particles. The investigation showed that with respect to sulfur oxides, the correlation is expected to be low during the summer and high during the winter, and low in coastal areas and high in the residential districts. The other pollutants tended to produce better correlation, but the significance level varied depending on geographical and time-of-day differences.

3184 APTIC NUMBER 20600

Tatarskiy, V. I.
ATMOSPHERIC TURBULENCE. Zemlya i Vselennaya, no. 2:43-46, 1968
Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div., May 21, 1969, 7p.
CFSTI, DDC: AD 693842

Atmospheric turbulence is illustrated by comparison with a water-filled tube containing visible particles. If the speed of the flow of water is not very great, the trajectories of each particle will be observed to be rectilinear. If the particles are released in the same place in the tube's cross section, they will move on the same trajectory in a liminar motion. However, if the speed of water is increased beyond a critical point, the motion changes character and the particles move not only along the axis of the tube, but also in the transverse direction. The trajectories of motion of liquid in turbulent flow become random. The effects of turbulence are seen in the action of an airplane when pressure on the wings is uneven, causing 'bumping'. Turbulence has a great effect in preventing heavy gases, smoke, radioactive waste, etc. from collecting on the surface of the earth. It also influences the heat cycle, refraction, propagation of radio waves, and astronomical observations. (Author abstract modified)

3185 APTIC NUMBER 20985

Telford, James W.
CONVECTIVE PLUMES IN A CONVECTIVE FIELD. J. Atmospheric Sci., 27(3):347-358, May 1970. 12 refs.

The theory of isolated turbulent plumes is used to study a field of plumes. Each plume is immersed in the turbulent downdraft which comprises the return flow. The field of flow is specified by three parameters: the heat flux into the atmosphere at the surface, the depth of the convecting layer, and the intensity of turbulence at the surface (where turbulence is steadily generated by the wind) and where a plume element which leaves the surface returns there in a downdraft after a period of 100 sec). The change in air properties during this period is the essence of the problem. Since the process is driven by the changing density resulting from heating, the equations describing the field must be time-dependent in this essential respect. Wind is neglected, and the horizontal pressure gradient is assumed to be the same at all heights. The derived plume properties-size, temperature excess, upward velocity and turbulent density -- are in agreement with observations. The formulation predicts a maximum possible depth for convection in the form of a field of plumes, depending on the magnitudes of heat flux and surface turbulence. As a result, it is suggested that the theory of a field of plumes

could lead to a prediction of the onset of a different form of convection, such as on a larger scale, resulting from instabilities in the convecting layer as a whole.

3186 APTIC NUMBER 21386

Thomas, John Charles
STUDIES OF CARBON MONOXIDE DIFFUSION IN AN URBAN AREA. Texas Agricultural and Mechanical Univ., College Station, Dept. of Meteorology, Thesis (M. S.), Jan. 1970, 166p. 28 refs.

Carbon monoxide as affected by traffic, wind speed, and wind direction near a freeway interchange and in a downtown region was studied. A wide variation was found in the relationships of CO and meteorological conditions from sampler to sampler. Vertical measurements exhibited similar CO concentrations. Rainfall had little effect on reducing CO concentrations. Reasonable results were obtained using an analytic solution, suggesting that CO concentrations close to the source can be determined with a mathematical model. Carbon monoxide concentrations were affected differently by meteorological conditions in a downtown region than in a freeway location. There was a positive correlation between CO and traffic. A negative correlation existed between CO and wind speed, while an almost zero correlation was found between CO and wind direction. (Author conclusions modified)

3187 APTIC NUMBER 20927

Titi, Edwin W.
PREDICTOR-CORRECTOR SCHEME FOR DIGITAL SOLUTION OF THE PARTIAL DIFFERENTIAL EQUATION FOR ATMOSPHERIC DIFFUSION FROM A LINE SOURCE. Arizona Univ., Tucson., Grant DA-AMC-28-043-66-G23, DA Task 1T061102B53A-17, TR-ECOM 66G23-F, 57p., June 1969. 25 refs.
CFSTI, DDC: AD 695691

The range and accuracy of the computer program for the predictor-corrector solution of the partial differential equation of atmospheric diffusion from a line source was extended. The computation was carried out by vertical slices proceeding in a downwind director, each slice requiring a matrix reduction. The equations of the system are the integrated conditions of Green taken over vertical strips of elements. The original equation was written so that the linearized terms carry the main burden, giving a predictor so accurate that little iteration is required. The idea of using two approximating nets is introduced when the demands of accuracy require a vertical step size too small for a stable process. one is a course net for the determination of the matrix. Values of the solution at points of the fine net are computed from Green's formula in an overdetermined fashion using boundary values coming from the coarse solution. In turn, the fine results can be used to improve the accuracy of the corrector for the coarse solution. (Author abstract modified)

3188 APTIC NUMBER 20523

Tsang, Gee
CONCENTRATION OF EFFLUENTS IN A PLUME AS PREDICTED BY A MODEL AND OBSERVED IN FIELD. Massachusetts Inst. of Tech., Cambridge, Fluid Mechanics Lab., Grant AP 00678-01, Pub. 69-7, 9p., Aug. 1969. 6 refs.

A theoretical model based on the entrainment concept and the assumption of a 'top-hat' distribution profile was used for predicting the concentration of SO2 and SF6 in a plume. The theoretical predictions were compared with field data collected by Berger et al and Dennis et al in a plume from a power station situated by the seashore. The sampling was made by an airplane criss-crossing the plume at various downwind distances and at various altitudes. To avoid the effect of ground roughness, sampling was only made when the plume was blown off-shore to the sea. The stretch of the plume being sampled was from 1/4 miles to 20 miles. The plume boundary was determined by an airborne electro-conductivity analyzer which could respond to an increment in SO2 levels above the background level within 5 seconds. The comparison shows that the theoretical model does correctly predict the concentration of pollutants in a plume. Comparison of the SO2 and SF6 concentrations (the latter was an inert gas released as a tracer) showed that in the experimental range of 20 miles, the depletion of SO2 is not an important factor in estimating the rate of dilution.

3189 APTIC NUMBER 21261

Tsang, Gee
CONCENTRATION OF EFFLUENTS IN A PLUME AS PREDICTED BY A MODEL AND OBSERVED IN FIELD. Fluid Mech. Lab. Pub. No. 69-7, 10p., Aug. 1969. 6 refs.
CFSTI: PB 188017

Field-measured data for sulfur dioxide and sulfur hexafluoride concentrations in a plume are compared with theoretical predictions based on a plume rise model. The comparison shows that the theoretical model does correctly predict the concentration of pollutants in a plume which varies with down wind distance to the -4/3 power. The comparison of SO2 and SF6, which was an inert gas released to the stacks as a tracer, shows that in the experimental range of 20 miles, the depletion of SO2 is not an important factor in estimating the rate of dilution. (Author abstract)

3190 APTIC NUMBER 21004

Vohra, K. G., K. N. Vasudevan, and P. V. N. Nair
MECHANISMS OF NUCLEUS-FORMING REACTIONS IN THE ATMOSPHERE. J. Geophys. Res., 75(15):2951-2960, May 20, 1970. 18 refs.

Measurements of Aitken nucleus concentrations in the free air at sea level showed that solar radiations can have a striking effect on the rate of nucleus formation. The initial experiments were made with filtered atmospheric air. Controlled addition of trace impurities, using a carrier gas, was then employed to find the role of different trace constituents in the formation of nuclei

conditions of irradiation by high-energy radiation and ultraviolet and visible light were also controlled. From the variety of reactions studied, the processes of oxidation, nitration, chloride formation, hydrolysis, hydration, and recombination of specific oppositely charged species forming inorganic acids seem to be some of the basic nucleus-forming reactions. The role of ozone in oxidation and that of water vapor in hydrolysis and hydration is important in gas-to-particle conversion in the atmosphere involving sulfur dioxide, chlorine, and oxides of nitrogen. The presence of organic vapors from the vegetation on the earth and their high reactivity with oxides of nitrogen and atomic chlorine suggest these reactions may be a source of nuclei. Nuclei formation in filtered air in the dark is due at least partly to the recombination of certain ionic species by natural ionization.

3191 APTIC NUMBER 21373

Wallington, C. E.
NUMERICAL SOLUTION OF ATMOSPHERIC DIFFUSION EQUATIONS. Meteorological Office, London, England, Scientific Paper no. 28, 18p, 1968. 8 refs.

Techniques are presented for solving atmospheric diffusion equations analytically with the aid of Laplace transform methods and numerically with the aid of moments and a high-speed computer. The techniques allow a wide range of wind and diffusion profiles to be accomodated in finite-difference forms in the vertical, and finite sources of material emitted to the atmosphere to be dealt with by convenient distributions other than Gaussian. The main advantage of the transform method is that the separate and combined effects of wind shear and diffusion appear as separate terms in the solutions, and comparisons between these effects can be made without solving the equations completely. The crux of the computing problem is the solution of an 'airstream' polynomial; this is feasible with a desk computer for diffusion regimes of up to seven layers. The numerical prediction technique requires only simple calculations to build up the solution, though care must be taken to ensure that time and distance intervals are not too large. The techniques are illustrated by application to a visiblility problem and to a cloud of falling particles. (Author abstract modified)

3192 APTIC NUMBER 21049

Wilson, Wm. E., Jr. and Arthur Levy
A STUDY OF SULFUR DIOXIDE IN PHOTOCHEMICAL SMOG. I. EFFECT OF SO2 AND WATER VAPOR CONCENTRATION IN THE 1-BUTENE/NO x/SO2 SYSTEM. J. Air Pollution Control Assoc., 20(6):385-390, June 1970. 14 refs.

There is an appreciable chemical interaction between sulfur dioxide and photochemical smog which depends on the concentration of SO2 and water vapor. The rate of SO2 concentration decay is greatly increased in the presence of photochemical smog. With 0.75 ppm SO2, a light-scattering aerosol is produced in dry systems and systems at 22% and 55% relative humidity. Aerosol is not observed until after the NO2 peak has been reached and the NO concentration has fallen to a very low value. The formation of aerosol corresponds in time to the region of most rapid decrease in the SO2 profile. In systems at 65% relative humidity or with smaller amounts of SO2, no light-scattering is observed, but the percentage of SO2 dissappearing is greater. In relatively dry systems, the presence of SO2 results in a general slowing down of the photochemical smog reactions. In systems containing water vapor concentrations comparable to those found in the atmosphere, the inhibiting action of SO2 on the smog reaction is less pronounced. However, the maximum concentration of oxidant produced by the photochemical smog reactions is significantly lower when SO2 is present. (Author abstract)

3193 APTIC NUMBER 21127

Wolf, M. A. and M. T. Dana
EXPERIMENTAL STUDIES IN PRECIPITATION SCAVENGING. In: Pacific Northwest Laboratory Annual Report for 1968 to the USAEC Division of Biology and Medicine Vol. II: Physical Sciences Part I. Atmospheric Sciences. Battelle-Northwest, Richland, Wash., Pacific Northwest Lab., p. 18-25, Nov. 1969. 7 refs.
CFSTI: BNWL-1051

Silver iodide test data were compiled and showed a well-defined relationship between washout coefficients and precipitation rates in rain. Test data from snow scavenging presented more scatter but revealed a relationship which did not differ markedly from that in rain. Further analysis of washout coefficients derived in previous tests of dry-generated fluorescent dye showed good agreement with theoretical values based on experimental collection efficiencies. The development of a capability for particle size control was undertaken to extend the precipitation scavenging studies of particle size effects. Measurements of raindrop electric charge data collected at a site on the Olympic Peninsula of Washington indicated predominantly positive charges. Calculated precipitation electric currents best describe the raindrop electrification, although the raindrop charge spectrometer transducer apparently does not effectively sample the entire raindrop spectrum. (Author abstract modified)

3194 APTIC NUMBER 20352

Yagyu, H., S. Izumikawa, Y. Sato, S. Kurashima, and S. Suzuki
CORRELATION OF AIR POLLUTANTS. (Taiki osen bussbitsukan no sokansei ni tsuite). Text in Japanese. Taiki osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):11, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

Various statistical methods are presented for analyzing the general tendency of various pollutants during atmospheric pollution and explaining how high concentrations or regular concentrations of carbon monoxides originate. Based on the data obtained at National Tokyo Air Pollution Observatory during 1968, tables of correlations between concentrations of various pollutants such as carbon monoxide, sulfur dioxide, nitrogen

dioxide, etc., were drawn up by means of random sampling for thirty hours when the carbon monoxide concentration was either above or below 30 ppm. Further statistical methods are delineated involving factor analyses and tabulation as well as diagrammatic representation of Canon's three factor analyses on the data.

3195 APTIC NUMBER 20353

Yazawa, M., Y. Watanabe, S. Wakamatsu, and T. Toyoguchi
STATISTICAL INFERENCE IN FREQUENCY DISTRIBUTION MODEL FOR AIR POLLUTION AREA. (Chiiki osen no tokeiteikeital ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):14, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The pattern of the frequency distribution of sulfur dioxide concentration was investigated based on the data obtained through continuous measurement at various cities; a time series analysis was conducted. Tokyo, Osaka, Sapporo, and Muroran in winter were the four cities under investigation. Some of the items examined were the difference in the times of appearance of high-density pollution in different areas, the relationship between high-density and wind direction, the yearly changes in the pattern of distribution of pollution frequencies, and lastly the time series analysis of pollution concentrations. Several graphical analyses are are also included.

3196 APTIC NUMBER 21321

Yokoyama, O. and T. Mizuno
AIR POLLUTION AND MICROMETEOROLOGY. (Taikiosen to kisyo). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 8(1):22-27, April 1, 1970. 3 refs.

The importance of atmospheric diffusion of pollutants to air-pollution control is explained. The atmospheric boundary layer, which is within 1 km from the earth's surface, plays the most important role in air pollution. Micrometeorology of the 50 to 60-m stratum adjacent to the earth is discussed, with particular emphasis on the stability of the upper and lower layers. Atmospheric conditions, including smog, resulting from the reversal of the layers are listed. For the purpose of quantitatively relating diffusion phenomenon to the stability of the atmospheric layer, the latter is defined in terms of air density, temperature, and friction velocity due to Reynolds stress. A relation between the stability and diffusion, proposed by Pasquill, is modified to fit the weather condition in Japan. Effects of distribution of mean wind velocity, diffusion coefficients, and intensity of turbulence on the atmospheric stability are discussed. An analysis of the diffusion problem by Bosanquet-Peason is presented, together with a comment on methods developed by Pasquill and others. The effect of stacks in atmospheric diffusion is explained on the basis of theory. The analytical method satisfactorily describes air pollution where air flow is steady and topography flat. Refinements are needed to make the method applicable to complex terrain and unsteady air-flow conditions.

3197 APTIC NUMBER 21110

Yung, Joseph T.
EVAPORATION RATES AND LIFETIMES OF CLOUDS AND SPRAYS IN AIR. III. THE EFFECTS OF CLOUD EXPANSION. J. Chem. Phys., 48(11):5181-5186, June 1, 1968. 8 refs.

Cloud expansion is examined in terms of Brownian motion, electric charge, and turbulent diffusion and dispersion; the assumption is made that the droplet system is monodisperse, the spreading is uniform throughout the whole cloud, and single droplets evaporate according to the Maxwell rate. Results obtained by using both the cellular and the continuum models for cloud evaporation show that the Brownian diffusion slightly speeds up the evaporation rates, and the electric charge has only a negligible effect; but the turbulent diffusion with a relative turbulent velocity of 1 cm per sec can shorten the lifetimes of a cloud by several hundred times. (Author abstract modified)

3198 APTIC NUMBER 21630

Alemasov, V. Ye. and A. F. Dregalin
THERMOPHYSICAL PROPERTIES OF COMBUSTION PRODUCTS OF CERTAIN CHEMICAL FUELS. Teplo- Massoperenos, vol. 7, 1968. 7 refs. Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div., p. 11-19, Aug. 20, 1969.

Methods are described for determining thermophysical properties of reacting combustion products of chemical fuels; these methods are applicable to a universal program developed for the M-20 electronic digital computer in obtaining calculation data for different mixtures. With this program, the fuel can contain up to 10 atoms of the 22 most widely distributed. Properties of individual components are calculated from seven-order polynomials approximating published tables of thermodynamic properties of compounds. The basis for the calculation of thermophysical properties of combustion products is a determination of equilibrium state and its corresponding derivatives at known temperatures and pressures. Thus, calculations are developed on the basis of the system of equations of thermodynamic equilibrium applicable when atoms are used as the base components. An example is given for the properties of combustion products of the chemical fuel C2H8N2 plus N2O4, for the coefficient alpha equals 0.8 of excess N2O4 compared to the stoichiometric concentration.

3199 APTIC NUMBER 21601

American Gas Association, Inc., New York, LNG Information Book Task Group
LIQUEFACTION. In: LNG Information Book July 1968, Chapt. 2, p. 18-33.

A natural gas liquefaction plant converts the gas received from pipeline or distribution mains into a liquid suitable for storage. The feed preparation or treating center removes carbon dioxide, water, and other natural gas constituents that could form solids when the gas liquefied; the liquefaction section removes the sensible and latent heat from the gas to convert it to a liquid at atmospheric pressure. Storage boiloff vapors which result from heat leaking into the storage container can also be handled by the liquefaction plant. Methods for removing water, hydrogen sulfide, CO2, and other contaminants are discussed. Liquefaction of natural gas may be accomplished by transfer through refrigerants to a high-level heat sink, such as cooling water of air, or by permitting the gas to do work, through the use of an expander. The first method utilizes a cascade cycle using several single-component refrigerants, or a modified cascade cycle which circulates a blend of hydrocarbons through a single refrigerant circuit. The fundamentals of each cycle are presented.

3200 APTIC NUMBER 21603

American Gas Association, Inc., New York, LNG Information Book Task Group
LNG PUMPOUT AND REGASIFICATION. In: LNG Information Book July 1968, Chapt. 4, p. 98-112.

Regasification or vaporization, which is the final step in the operation of a liquefied natural gas facility, is accomplished by the addition of heat from ambient air, ambient water, direct-fired or indirect-fired vaporizers. LNG is usually stored at its boiling point and slightly above atmospheric pressure. Therefore, the liquid must be pumped to a sufficient pressure before vaporization so the gas can enter the transmission or distribution system. Vertical multistaged deepwell turbines, multistaged submersible, and multistaged horizontal pumps are used to raise the pressure of LNG before vaporization, but an additional system is required to cool down the supply line to the pumps and avoid cavitation and subsequent overheating. Direct-fired vaporizers employ no intermediate heat exhange medium, but heat the tubes through which the LNG is flowing, either by direct impingement of flame, radiation, or by convection of hot combustion gases. Indirect-fired heat exchangers employ intermediate heat transfer media to carry the heat generated by the burning fuel to the tubes where the LNG is vaporized. The medium is usually a fluid, such as isopentane, propane, or butane. Vaporizers heated by the ambient temperature of air or water in heat exchange with LNG are used more for base load than peak load operation. It is essential that vaporizing systems include a reliable control scheme to ensure that sendout gas is available at the vaporizer outlet at a desired pressure, temperature, and flow rate. Various control schemes are discussed, and illustrations of the different types of vaporizers are presented.

3201 APTIC NUMBER 20359

Asami, M., S. Esaka, S. Musakabe, K. Kitazawa, and K. Yamakawa
STUDIES ON THE MECHANISM OF SO2 - PbO2 REACTION BY MEANS OF AN APPARATUS, GENERATING SO2 IN CONSTANT CONCENTRATION. PART II. (Teinodo SO2 hassei sochi ni yoru PbO2 - SO2 hannokiko no kenkyu: dai niho). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):22, 1969. 2 refs. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The influence of temperature and humidity on the lead dioxide-sulfur dioxide reaction was investigated pursuant to the earlier report on the functional characteristics of a 'constant concentration sulfur dioxide generator' constructed with required scale and accuracy as wll as a 'reaction chamber' maintained at constant temperature and humidity. The experiments were conducted according to the methods described, and observations were made on the following items: the effect of temperature on the adsorption rate of sulfur dioxide under dry conditions, the time variation in the adsorption rate, and the effect of humidity on the adsorption rate as well as the reaction quantity. The results indicate that H2O plays the role of promoting the reaction speed between sulfur dioxide and lead dioxide.

3202 APTIC NUMBER 20645

Ayen, Richard J. and Ali Amirnazmi
CATALYTIC REDUCTION OF NITROGEN DIOXIDE WITH HYDROGEN. Ind. Eng. Chem. Process Design Develop., 9(2):247-254, 1970. 11 refs. (Presented at the American Institute of Chemical Engineers 65th

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National Meeting, Cleveland, Ohio, May 1969.)

The reduction of nitrogen dioxide with hydrogen and four solid commercial catalysts was studied in a flow reactor operated at atmospheric pressure and 160 to 270 C. Reactant partial pressures were varied from 0.0007 to 0.1 atm. For the catalysts studied, nitrogen, ammonia, and water were the only important products. For a barium-promoted copper chromite catalyst, the effects of temperature, initial reactant concentrations, and space velocity on the N2 to NH3 ratio in the products were investigated. The relative abundance of N2 increased with increasing space velocity. Differential kinetics data were taken with this cayalyst and fitted to a rate expression. The rate increased with increasing H2 pressure and was inhibited by NO2. (Author abstract)

3203 APTIC NUMBER 21141

Bauch, Heinrich, Harry Burchard, and Helmut Kettner
RESULTS OF MEASURING THE DIFFUSION RATE IN TWO KETTNER SO2-GAS PROPORTIONING DEVICES (GAS DIFFUSERS) IN THE TEMPERATURE RANGE BETWEEN 32.5 AND -8 C. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(10):21-22, Oct. 1969. 2 refs.

Diffusion instruments for gas proportioning must exhibit uniform emission rates and good reproducibility, even when temporarily exposed to other temperatures. To simulate natural environmental conditions to which gas diffusers can be subjected, Kettner gas diffusers were tested from -8 to 40 C. Sulfur dioxide was the test gas. The diffusion rate of a Kettner diffuser is almost linearly dependent on temperature between 12 and 28 C. Below 12 and above 28 C the diffusion rate increases considerably. The change in the rate of diffusion in the room temperature range around 20 C is less than 1% per degree on the average. The reproducibility of emissions is good at the same temperature; it does not change when the instrument is either cooled or heated. Since the reproducibility of the values is good, it is suggested that a thermostat is no longer required for short-time determinations, which is an important possibility in field tests where the use of electrical thermostats is rather expensive.

3204 APTIC NUMBER 17716

Baume, Georges and Georges -P. Pamfil
QUANTITATIVE INVESTIGATIONS OF VOLATILE SYSTEMS: FUSIBILITY CURVES OF SYSTEMS FORMED BY HYDROCHLORIC ACID AND SULFUR DIOXIDE WITH METHYLALCOHOL; MECHANISM OF THE FORMATION OF ESTERS. (Recherches quantitatives sur les systemes volatils: Courbes de fusibilite des systemes formes par l'acide chlorhydrique et l'anhydride sulfureux avec l'alcool methylique; mechanisme de la formation desesters). Text in French. J. Chim. Phys., vol. 12:256-269, 1914. 25 refs.

The solidification of the following binary systems were determined: CH3OH-HCl; C2H5.CO2H-CH3OH, (C2H5CO2H.HCl)-CH3OH; (CH3OH.HCl)-C2H5CO2H; CH3OH-SO2; and SO2-HCl. The objective of these determinations was to obtain new confirmations on the mechanism of chemical reactions. The existence of the following, but unstable, intermediate addition compounds was established: a) CH3OH+HCl; b) CH3OH+C2H5CO2H+HCl; c) CH3OH+SO2; and d) 2CH3OH+SO2. Compounds a and b may be considered as the first stages of formation of the halogen derivatives of alcohols and esters. Moreover, compound b offers a particularly simple example of chemical catalysis by inorganic acids. In contrast with 'physical catalysts' which raise artificially and locally the temperature or pressure and thus create a state of affairs which an overall rise of temperature or pressure would produce without their intervention, 'chemical catalysts' form addition compounds with the substances whose mutual reaction they facilitate or provoke. Compounds c and d solidifying respectively at about -71 C and about -81 C form a part of a system with a simple 'oxonian' phase diagram, in which they alternate with eutectic points at about -88 C at 45 mole % CH3OH, at about -91.5 C at 62 mole % CH3OH and at about -106 C at 89 mole % CH3OH. The SO2-HCl system has a simple eutectic point at -133.5 C at 80 mole % SO2.

3205 APTIC NUMBER 21170

Beal, S. K.
AGGLOMERATION OF PARTICLES IN TURBULENT FLOW. Bettis Atomic Power Lab., Pittsburgh, Pa., Contract AT-11-1-GEN-14, 21p., Sept. 1969. 10 refs.
CFSTI: WAPD-TM-904

Preliminary analysis indicates that agglomeration of particles in turbulent flow is competitive with deposition in its effect on the coolant-borne particle size distribution in the Shippingport reactor. In a typical situation, the agglomeration rate exceeds the deposition rate for particles smaller than 0.01 micron. The reverse is true for particles larger than 10 micron; and in the range of 0.1 to 1.0 micron, the two rates are about equal. Comparison of theory and experiment shows poor agreement regarding the magnitude of the agglomeration rate/deposition rate relationship but good agreement regarding the trend of the relationship with Reynolds number, providing some indication that the theoretical concept is basically correct. (Author abstract)

3206 APTIC NUMBER 20599

Berner, Axel
ON THE ANGULAR VELOCITIES OF THE CARRIER GAS IN THE ROSL SPECTROMETER. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(6):30-33, June 1969. 3 refs.

The ROSL aerosol spectrometer constitutes a conifuge with a cylindrical chamber. Aerosol particles do not travel with the angular velocity in the chamber, but rather with the angular velocities of the carrier gas which vary from place to place. As calculated from theoretical and calibration curves, differences between mean angular velocities along a trajectory ending in the upper part of the chamber and those along a trajectory ending near the bottom of the chamber can reach 20%. The differences are compensated by friction, which is a purely time-dependent process. Because flow rate cannot be measured in the ROSL spectrometer,

the difference between the angular velocity of the carrier gas and the angular velocity of the chamber was not determined.

3207 APTIC NUMBER 21306

Riedenkapp, O. and Edward J. Bair
OZONE ULTRAVIOLET PHOTOLYSIS. I. THE EFFECT OF MOLECULAR OXYGEN. J. Chem. Phys., 52(12):6119-6125, June 15, 1970. 17 refs.

To clarify the role of molecular oxygen in the photolytic decomposition of ozone, measurements of mixtures of ozone with helium, nitrogen, or oxygen were analyzed by the intermediate quantum yield method which separates effects due to fast and slow reactions by measuring the fast components shortly after flash photolysis. The ozone decomposition at infinite time is virtually complete when the extent of primary photolysis is greater than about 10%, except in oxygen, where recombination returns the quantum yield to zero within errors of experimental measurement. The ozone disappearance during the first millisecond after flash photolysis is satisfactorily represented, over the range of conditions studied, by reactions the rate constants of which are compared with those obtained in other laboratories.

3208 APTIC NUMBER 21598

Bishop, Clyde E. and Paul R. Story
MECHANISM OF OZONOLYSIS. REDUCTIVE CLEAVAGE OF OZONIDES. J. Am. Chem. Soc., 90(7):1905-1910, March 1968. 9 refs.

Following the method of Iohaus, dimethyldodecenedione was synthesized and labeled using 40.61% oxygen-18 water according to the general procedure of Byrn and Calvin. The possibility of zwitterion polymerization was reduced in this system by the presence of the intramolecular carbonyl. From examination of the molecular models it was observed that the internal carbonyl is sterically restrained from reacting with a molozonide intermediate, thus further ensuring that ozonide is formed via the Criegee mechanism. That the oxygen-18 label is located at the ether oxygen is supported by the finding that 2-pentanone did not contain an isotopic label. Lithium aluminum hydride reduction of dimethyldodecenedione produced 2,6-heptanediol containing 15.5% isotopic label, i.e., essentially no isotopic label was lost during reduction. Analysis of the diols by mass spectrometry permitted the conclusion that hydride reduction of the above ozonide and, by extension, other saturated, alkyl-substituted ozonides, occurs with loss of oxygen only from the peroxide bridge.

3209 APTIC NUMBER 21376

Bloom, H. and J. O'M. Bockris
MOLTEN ELECTROLYTES. In: Modern Aspects of Electrochemistry. J. O'M. Bockris (ed.), London, Butterworths, 1959, Chapt. 3, p. 160-261. 233 refs.

There is an immense technological importance of molten electrolytes which are being used on a continually larger scale for such processes as the electrolytic extraction and purification of elements, together with more recent uses in nuclear reactors, and their study is of direct importance to an understanding of that section of the liquid state in which the force field is mainly coulombic. A wide variety of methods are used in the study of molten electrolytes, including heat and entropy of fusion, X-ray diffraction, Raman spectra, ultraviolet spectra, molar volume, electrical conductance, viscosity, vapor pressure, cryoscopy, compressibility, refractive index, diffusion, transport number, e.m.f. of cells, surface tension, heat capacity, and salt-metal equilibria. The type of particles present, holes present in the structure, distribution functions relating to particles and holes, and interionic forces, are all concepts basic to the consideration of molten electrolytic structure and discussed from the results of the above investigations.

3210 APTIC NUMBER 21183

Boisdron, Y. and J. R. Brock
ON THE STOCHASTIC NATURE OF THE ACQUISITION OF ELECTRICAL CHARGE AND RADIOACTIVITY BY AEROSOL PARTICLES. Atmos. Environ., vol. 4:35-50, 1970. 19 refs.

The distributions of charge and radioactivity in an aerosol arising from the stochastic nature of the acquisition processes are discussed. The general theory of the equations employed is developed. The electric charge distribution resulting from the unipolar diffusion charging of a monodisperse aerosol is derived. The kinetics of the adsorption of radioactive iodine and RaA on a monodisperse aerosol and the resultant distribution of radioactivity are described. These illustrate the fact that even for monodisperse aerosols, one can expect substantial stochastic variations in attached electrical charge and radioactivity. In general, it is clear that experimental measurements of technical processes involving aerosols which ignore the stochastic variations demonstrated here may be quite misleading. (Author abstract modified)

3211 APTIC NUMBER 21620

Bourguet, J. M.
SELECTION OF REFRIGERATING COMPRESSOR DRIVING MACHINES FOR LARGE-CAPACITY NATURAL GAS LIQUEFACTION INSTALLATIONS. Text in French. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 37p. (April 7-12, Paper 5-29a.)

Natural gas liquefaction processes are discussed, including the classic cascade cycle which utilizes a series of several fluid refrigerants in their pure form, and the so-called autorefrigerated cycle in which a single liquid refrigerant is used, this comprising mixture of gases contained originally in the natural gas itself. Liquefaction at atmospheric pressure

required a temperature of -162 C, which is used at the CAMEL Liquefaction Plant in Algeria where propane, ethylene, and methane are employed as the refrigerants. Gasoline-operated compressors used for liquefaction require a power input of 4,000 kilowatts, gas turbines require 40,000 kilowatts, and steam turbines as much as 100,000 kilowatts. The yield of the energy cycle is between 20% and 30%. A gas liquefaction plant in Algeria uses an average of 430 KWH per ton of LNG produced. The autorefrigerated procedure uses a mixture of hydrocarbons and nitrogen for its refrigerant, the composition of which is varied according to the relationship between the vaporization curve and the liquefaction curve at any given moment. Choice of a power source for gas-compressing plants includes steam turbines, gas turbines, aviation-type turbines, and industrial gas turbines. Criteria are given for choosing between steam and gas turbines.

3212 APTIC NUMBER 20907

Boyarchuk, I. F.
METHOD FOR THE DYNAMIC INHALATION INOCULATION OF ANIMALS WITH HYGROSCOPIC DUSTS. Farmakol. i Toksikol., 26(3):377-381, 1963. Translated from Russian. Fort Detrick, Frederick, Md., 7p., Jan. 1969.
CFSTI, DDC: 683043

The chronic action of aerosols on animals during conditions of dynamic inhalation poisoning were studied for a toxicological study of complex fertilizers and determination of maximum permissible concentrations of fertilizers containing nitrogen, phosphorus, and potassium. A method was developed for creating persistent levels of hygroscopic aerosols to meet this requirement. A vibration sprayer was modified to obtain constant high parameters of vibration of the sprayer body by replacing the vibrating plates with rubber backing and increasing the mass of the body of the induction coil. This modification not only made it possible to create persistent aerosol levels but prevented clogging of the tubes feeding the aerosol to the chamber. The air introduced to the sprayer is preliminarily dried on silica gel and then at 60-70 deg in an electro-heating element. The dried, heated air is then fed into the chamber, the final form of which consists of a hollow conical cylinder with 15 individual booths. This arrangement will exclude the cutaneous action of the aerosols and ensure uniform concentration levels.

3213 APTIC NUMBER 20880

Brau, Guy
STUDY OF THE CATALYTIC EFFECT OF AN UNSTOICHIOMETRIC MIXTURE OF URANIUM AND THROIUM OXIDES ON THE OXIDATION OF CARBON MONOXIDE. (Etude de l;activite catalytique des oxydes mixtes d'uranium et de throium non stoechiometriques dans l'oxydation du monoxyde de carbone). Text in French. Commissariat a l'energie Atomique, Fontenay-aux-Roses (France), Centre d'Etudes Nucleaires Dept. CEA-R-3798, 74p., June 1969. 68 refs.

The study of the catalytic properties of unstoichiometric solid solutions of uranium and throium oxide was undertaken with the hope of comparing these with the pure thorium orides resulting from thermolysis of thorium nitrate and thorium oxalate. The conditions of preparation of these orides were controlled in order to obtain homogenous, isotropic solid solutions. Thermolysis of the mixed oxalates of uranium and thorium yielded catalysts of known composition and structure. Variations of the crystalline parameter were plotted against uranium content to obtain a stoichiometric graph. The fundamental characteristic of these mixed oxides is the presence of interstitial oxygen atoms, their quantity depending on the composition of the atmosphere around them. Analysis of the chemisorption of reagents in the oxidation of carbon monoxide suggested the possibility of oxidation-reduction of the active surface, the interstitial oxygen atoms being removed one by one by the carbon monoxide, for which they constituted a preferential adsorption site. These were then replaced by oxygen atoms derived from the gaseous phase. The study confirmed the electrical conductivity of the chemisorption of CO, when the adsorbates were analyzed by infrared spectrophotometry. Utilizing these investigations and the kinetics of catalytic reaction, it was possible to partially describe various stages by which CO is oxidized in the presence of mixed oxides with an increasing uranium content, in the presence of an excess of oxygen. A chemical description is given of the mechanism involved in the catalysis of pure thorium oxide.

3214 APTIC NUMBER 20558

Brauman, John I. and David M. Golden
ALTERNATE ELECTROCYCLIC PATHWAYS. A QUANTITATIVE ENERGY EVALUATION. J. Am. Chem. Soc., 90(7):1920-1921, March 27, 1968. 10 refs.

According to the Wood-Hoffman rules, an unfavored process in electrocyclic reactions will occur only with high activation energies or at high temperatures in situations where the favored process is impossible due to steric constraints. The gas-phase, unimolecular valence isomerization of bicyclo(2.1.0) pent-2-ene is a disrotary reaction constituting a counterexample to the Woodward-Hoffman rules. The reaction has a lower activation energy and proceeds at a lower temperature than the conrotary reaction predicted by the rules. The energy difference between alternate electrocyclic pathways in cyclobutene isomerization was quantitatively evaluated. The transferable quantity with which the Woodward-Hoffman rules deal is proposed as the unstrained bond dissociation energy of the bond between the termini of the gamma system in the transition state. Compounds with unusually strained ground states will react unusually rapidly only if the corresponding transition states are relatively strain free, and reactions involving unusually strained transition states will be slow only if the ground states are relatively less strained. As determined by an analysis of its unstrained bond energy, bicyclo(2.1.0)pent-2-ene reacts rapidly because the transition state is significantly less strained than the ground state. The analysis clearly shows that the difference in energy with which the Woodward-Hoffman rules deal is approximately equal to 15 kcal/mol. Thus compounds with essentially no added strain for either pathway react only by the allowed process.

3215 APTIC NUMBER 21067

Brenchley, David Lee
AN EXPERIMENTAL INVESTIGATION OF COMBUSTION PRODUCTS THROUGH A FLAT, LAMINAR, PREMIXED HYDROCARBON-AIR FLAME. Oregon State Univ., Corvallis, Dept. of Mechanical Engineering, Thesis (Ph.D), Ann Arbor, Mich., Univ. Microfilms, Inc., 1968, 190p. 57 refs.

A controlled laboratory combustion system was used to investigate the operating parameters of combustion: type of fuel, equivalence ratio, wall temperature, and sampling position. The system consisted of a porous-plate flat-flame burner enclosed in a chamber, producing a one-dimensional, steady-state flame, propagated toward a relatively cool wall. The quantity of methane, ethane, ethylene, propane, propylene, acetylene, carbon monoxide, carbon dioxide, and oxides of nitrogen were measured in the vicinity of the wall for various fuel types, equivalence ratios, wall temperatures, and sampling positions. 'Dead space' thickness and luminous flame zone thickness were measured, and observations were made of the point in the flame zone where the hydrocarbon concentration approaches zero. Temperature profiles were measured at various points in the flame zone. Chemical reaction takes place within the dead space; CO and CO2 concentrations at the plate surface are not completely explained by diffusion processes. The concentration of stable hydrocarbons in the reaction zone is dependent on fuel type, equivalence ratio, sampling position, and sometimes the plate temperature; ethylene is the major stable hydrocarbon species when propane and propylene are used as fuels. Dead space thickness is a function of fuel type, equivalence ratio, and plate temperature; the hydrocarbon disappearance point is a function of equivalence ratio and plate temperature. Luminous flame zone thickness is dependent only on fuel type and is larger for propylene than for propane. Concentration of nitrogen oxides depends on fuel type, equivalence ratio, plate temperature, and sampling position.

3216 APTIC NUMBER 20438

Briner, E., G. Paam, and H. Paillard
INVESTIGATIONS ON THE RATE OF THERMAL DISSOCIATION OF SULFATES OF CALCIUM, POTASSIUM, AND SODIUM, ALONE OR IN THE PRESENCE OF ADJUVANTS; STRONGLY ACCELERATING ACTION OF WATER VAPOR. (Recherches sur la vitesse de dissociation thermique des sulfates de calcium, de potassium et de sodium, seuls ou en presence d'adjuvants; action fortement acceleratrice de la vapeur d'eau). Text in French. Helv. Chim. Acta, 32(85):635-646, 1949. 20 refs.

The rates of thermal dissociation of calcium sulfate, potassium sulfate, and sodium sulfate were determined, to assess the use of thermodynamic formulas to predict the effect of increased temperature or the addition of adjuvants on the rate of dissociation and to verify the strong accelerating effect of water vapor on that rate. The apparatus used in the dissociation test and the preparation of the three sulfates and of silica, kaolin, and bauxites used as adjuvants were described in a previous paper SO2 with traces of SO3 released upon decomposition of the sulfates, were absorbed in a known volume of 0.1 N caustic soda. The latter was titrated with 0.1 N hydrochloric acid in the presence of phenolphthalein to determine the amount of SO2 absorbed. The results of dissociation are expressed in terms of the percentage of the sulfate which had dissociated in the course of one hour at the specified test conditions. The rates of dissociation at different temperatures between 800 and 900 C and with different adjuvants and without or with H2O vapor are listed. Silica and, particularly, metakaolin (obtained by calcination of kaolin at 800 C) increased significantly the rate of dissociation of the sulfates. The effect of H2O vapor was very strong, also, in the presence of the adjuvants.

3217 APTIC NUMBER 20577

Brodovich, K. I.
REACTION KINETICS OF SULFUR DIOXIDE OXIDATION ON VANDIUM CATALYSTS. (K voprosu kinetiki reaktsii okisleniya sernistogo gaza na vanadievykh katalizatorakh). Text in Russian. Zh. Prikl. Khim., 14(7-8):894-899, 1941. 11 refs.

Experimental verification of theoretical studies into the reaction kinetics of sulfur dioxide oxidation was carried out using various reaction mixtures (O2 content: 40.0, 18.9, and 9.4%). Oxygen content had a direct effect on reaction rate in the presence of vanadium catalyst, thereby confirming the reaction rate equation presented.

3218 APTIC NUMBER 21043

Burcat, Alexander and Assa Lifshitz
KINETICS OF THE REACTION NO2 + YIELDS NO + CO2. J. Phys. Chem., 74(2):263-270, Jan. 22, 1970. 15 refs.

The kinetics of the homogeneous reaction NO2 + CO yields NO + CO2 was studied in a single-pulse shock tube from 1050-1500 K. Six reaction mixtures, covering the range of 0.743-8.55% NO2 and 1.25-5.0% CO in argon, were used. Product analysis was carried out by vapor-phase chromatography. The power rate expression that best fits the experimental data is presented. The value for the rate falls slightly above the extrapolated Arrhenius curve of three low-temperature studies. The reaction is assumed to proceed via a three-center atomic displacement mechanism. (Author abstract modified)

3219 APTIC NUMBER 21106

Burkinshaw, L. D.
PPO FOAM FOR CRYOGENIC APPLICATIONS. Institute of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 12 p. (April 7-12, Session No. 5, Paper 33.)

The low-temperature properties and potential applications of an anisotropic, open-celled foam developed from polyphenylene oxide (PPO) are described. An elongation of greater than 4% has been measured in molded specimens of PPO at a temperature of -320 F.

Samples that have been immersed in liquid nitrogen and then crushed still show some elongation. This contrasts with the brittleness of polyurethane and vinyl foams tested under the same conditions. Although both air and water will pass through PPO foam, experiments indicate that it is an effective barrier for both liquid nitrogen and liquid methane when the foam is used as one wall of a small container. In one series of tests using foam of 2.5 lbs/cu ft, the depth of penetration of liquid nitrogen into the open cells was less than 0.25 cm. In addition, increasing the pressure on the same by 1 kg/cm made only a modest difference in the depth of penetration. The open-celled PPO foam is suggested as a component for a novel insulation system for cryogenic liquids. A proposed container would consist only of a PPO foam liner and an outside metal housing. This construction could significantly reduce both the weight and cost of cryogenic containers. It is also believed that PPO foam would be a useful pipe insulation for cryogenic fluids and would lend itself to novel designs of Dewar flasks. (Author abstract modified)

3220 APTIC NUMBER 20442

Campbell, R. W. and Jon E. Browning
MATERIALS OF CONSTRUCTION FOR CRYOGENIC PROCESSES. Chem. Eng. 1967:188,190, 192, 198, 196-7, Oct. 23, 1967.

Materials engineering considerations related to structures designed to operate below -250 F are examined. Allowable steel, aluminum, and copper alloys are reviewed. Requirements for cryogenic piping, valves, and insulation are also considered. The use of so-called superinsulation (alternate layers of insulation and radiative shields) is discussed, together with special cryogenic safety considerations. Although corrosion does not pose a problem in handling supercooled liquids, the requirements for thermal expansion, thermal isolation, and safety impose severe restrictions.

3221 APTIC NUMBER 21290

Castellano, E. and H. J. Schumacher
KINETICS AND MECHANISM OF PHOTOCHEMICAL OZONE DISSOCIATION UNDER LIGHT OF THE WAVE LENGTH 313 NM. (Die Kinetik und der Mechanismus des photochemischen Ozonzerfalles im Licht der Wellenlaenge 313 nm). Text in German. Z. Physik. Chem. Neue Folge (Frankfurt), 65(1-4):62-85, 1969. 29 refs.

The kinetics of ozone dissociation under the influence of monochromatic light of the wave length 313 nm was studied between +25 C and -25 C. The initial pressures of ozone were varied between 15 and 300 torr; those of oxygen, between 0.2 and 600 torr. Numerous experiences in the presence of varying quantities of inert gases such as CO2, N2, He, Ar, and Xe were performed. One experiment was carried out by adding several torr water vapor. The quantum yield in the oxygen- and alien gas-free system reached 6.0 mol/hr nu. This value was independent of the pressure of ozone and of the temperature. In the presence of sufficiently high alien gas pressures, the value dropped to 4.0 mol/hr nu and was also independent of the ozone pressure and temperature. The speed was strictly proportional with the first potency of absorbed light. Oxygen impaired the reaction. Inert gases exerted a delaying influence on the dissociation. Water vapor changed the reaction process completely by greatly accelerating it.

3222 APTIC NUMBER 21387

Chanot, C., A. S. Kennedy, P. J. Croke, J. J. Roberts, H. Moses, and J. B. Anderson
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAM-APICS-A COMPUTERIZED AIR POLLUTION DATA MANAGEMENT SYSTEM. Argonne National Lab., Ill., Center for Environmental Studies, 384p., Feb. 1970. 20 refs.
CPSTI: ANL/PS-CC-006

A computerized data management and analysis system was developed as an aid to research associated with the Chicago Air Pollution System Model Project at Argonne National Laboratory. The title acronym selected, APICS, stands for Air Pollution Information and Computation System. Two capabilities designed into the system are the ability to incorporate data in the master file from sources that could not be anticipated and the facility to add new computational programs to operate on the stored data base. The system includes programs to create and maintain master files of meteorological and air pollution data; to search master files for desired information; and to pass the data to the various analysis and computational programs. A multiple source atmospheric dispersion model program may be used to calculate projected pollution levels. Other programs provide graphical and printed display of selected data, and results of statistical analysis, including tables for predicting local pollution levels based on meteorological phenomena. The manual documents those aspects of the system which may be generally applied to similar situations in other cities and indicates how other data types and analysis programs could be incorporated into the system.

3223 APTIC NUMBER 21522

VERSATILE VALVE IMPROVES JOULE-THOMSON CYCLE. Chem. Eng., vol. 75:64, Feb. 12, 1968

The liquefaction of gases, required to reach temperatures of 2 to 4 K, is mostly accomplished by a Joule-Thomson cycle involving precoolers and heat exchangers, a large compressor, an expansion valve, and a condenser. A new expansion-ejector valve is described that is coupled with an auxiliary condenser and expansion valve on the suction side of the ejector to provide a secondary refrigeration cycle and achieve a lower temperature using the same compressor. Kinetic energy associated with the compressed gas entering an expansion valve, and which is normally dissipated through throttling, now is employed to produce further cooling in the auxiliary loop. The low temperatures are obtained with higher compressor suction pressures than previously obtainable, and process efficiencies are higher due in part to the lower specific power consumption of the compressor. A helium liquefier based on this new valve is commercially available.

3224 APTIC NUMBER 21593

Clough, P. N. and B. A. Thrush
VIBRATIONAL EMISSION BY NO2 IN REACTION OF NITRIC OXIDE WITH OZONE. Trans. Faraday. Soc., 65(1):23-31, Jan. 1969. 13 refs.

Vibration-rotation emission associated with certain transitions of nitrogen dioxide is observed from the reaction: nitric oxide plus ozone yields NO2 plus oxygen. The reaction also yields electronically excited NO2. The vibrationally excited molecules are produced predominantly by radiation and collisional quenching of electronically excited NO2 followed by rapid redistribution of vibrational energy rather than by direct population of high vibrational levels of the ground state. (Author abstract)

3225 APTIC NUMBER 20274

Collins, Conrad G., Jr.
A REVIEW OF SULPHUR FLAME TECHNOLOGY. (PART 2). Sulphur Inst. J., 6(1):18-22, Spring 1970. 52 refs. Part I. Ibid, Winter 1969-70.

The encounter and reaction of sulfur dioxide with an oxygen atom appears to be the predominant mechanism for sulfur trioxide formation according to most studies of stack gases and the hydrogen sulfide flame. The mechanism can be important only in flames with high temperature (1200 C) zones for the formation of atomic oxygen, as at lower temperatures, the slow homogeneous reaction between SO2 and molecular oxygen appears to be a two body collision reaction. Catalytic action of nitric oxide for oxidizing SO2 to SO3 is questioned in lower temperature regions where SO2 would react only with molecular oxygen, but if high temperatures prevail, such that the oxygen atom concentration is appreciable, the catalytic effect of NO may be established. Experimental work with hydrogen chloride added to the flame (nucleophilic partner) yielded 38% SO3, and HCl was viewed as a stabilizing medium for SO3. Different sulfur oxide species have been detected spectroscopically at a variety of conditions, from low temperature to the high temperature of shock waves.

3226 APTIC NUMBER 20948

Decker, Leon J., Jr. and John R. Kelso
LABORATORY PROCEDURES FOR THE PURIFICATION OF NITRIC OXIDE AND THE PREPARATION AND PURIFICATION OF NITROGEN DIOXIDE. Ballistic Research Labs., Aberdeen Proving Ground, Md., Interior Ballistics Lab., Project RDT AND E 1T061102B13A, Mem. Rept. 1979, 17p., Aug. 1969.
CFSTI, IDDC: AD 693781

Laboratory procedures involved in the purification of nitric oxide and the preparation and purification of nitrogen dioxide are described in detail. The impurities most commonly found in commercial NO and NO2 are other oxides of nitrogen, water vapor, carbon dioxide, carbon monoxide, nitrogen, and oxygen. Most of the higher oxides of N2, N2O, CO2, and NO2 are removed by passing commercial NO through dry iceacetone cooled traps followed by a column of an indicating alkaline-based absorbent. N2, O2, CO and other noncondensable gases are removed by evacuation of a liquid nitrogen cooled trap containing the condensed, solid NO. The removal of N2O from NO is more difficult. Commercial 'research grade' NO may contain as much as 2% N2O. It is effectively removed from NO by repetitive fractional distillations. NO2 is prepared from prepurified NO to avoid the difficult separation of CO2 and H2O from NO2. Any N2O remaining in the product is readily removed by hard pumping at -70 C. The detection and measurement of residual impurities are discussed. (Author introduction modified)

3227 APTIC NUMBER 20871

Desai, S. V. and W. H. Corcoran
SOME NEW TRANSITION PROBABILITIES OF ARGON I IN THE RANGE OF 5000-6500 A AND THE ROLE OF A NONUNIFORM SOURCE TEMPERATURE. J. Quant. Spectro. Radiative Transfer, vol. 8:1721-1730, 1968. 12 refs.

New or improved experimental values for certain transition probabilities of argon I were obtained using a radiofrequency, induction-coupled argon plasma as the source of excitation, and intensities of twenty-six lines of the argon I spectrum in the wavelength range of 3000-6500 A were measured with a photomultiplier tube. The transition probabilities of eighteen new lines were determined from the known values for eight lines, assuming local thermodynamic equilibrium. The radial temperature gradient introduced a slight deviation from linearity in the plot of log(Ina lambda nm/gnAnm) vs. En; but because the effect was very small, it was practically obscured by the larger errors in experimental measurements. For the gas under observation the measured temperature is the space-average temperature Tn, defined by a relationship consisting of the number of atoms per unit volume at radial position r in the nth excited state, and the average number of atoms per unit volume at the nth excited state in the zone viewed by the spectrometer. The value of Tn is approximately 7% lower than the true radial temperature at the axis of the jet, with the difference becoming less toward the periphery, and is weakly dependent on the level of excitation. (Author abstract)

3228 APTIC NUMBER 20867

Diogenov, G. G.
TERNARY SYSTEM OF LITHIUM, SODIUM, AND POTASSIUM ACETATES. J. Inorg. Chem. (English translation from Russian of: Zh. Neorgan. Khim.), 1(11):2551-2555, 1956. 2 refs.

The ternary system composed of lithium, sodium, and potassium acetates was studied by a visual-polythermal method of physico-chemical analysis with the aid of chromel-alumel thermocouple. Initial substances were twice recrystallized and dehydrated by prolonged storage at 300 deg. Sodium acetate melts at 337 deg, potassium acetate at 310.5 deg, and lithium acetate was determined for the firt time to melt at 291 deg and to be stable up to 300 deg. All three salts undergo polymorphous

transformations at 15 to 20 deg below their melting points. A comparision of this system with ternary systems composed of lithium, sodium, and potassium chlorides, nitrates, and carbonates shows that the acetate system is characterized by strong tendency towards coupler formation.

3229 APTIC NUMBER 20598

Doetsch, Erwin, Hans-Adolf Friedrichs, Ottmar Knacke, and Josef Krahe
THE KINETICS OF ELECTRICAL CHARGING OF AN AEROSOL. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(7):24-30, July 1969. 15 refs.

Electrical gas scrubbing involves mainly two convection currents (the gas stream and the ion stream) with ion concentrations of 10 to the eight power cu cm. As determined by 2400 charge measurements of crosscurrents of monodisperse aerosols and ions, concentrations and drift velocities of ions do not vary independently of one another but are coupled as a function of electric field strength. At an ion concentration of about 10 to the eighth power cu cm and a field intensity of up to 1,000 volts/cm, a monodispersed aerosol of a particle diameter of 1.3 micron is charged during a residence time of about 0.02s. The experimental results are described by a differential equation which indicates that two mechanisms participate in charging in a crosscurrent: ion bombardment and thermal diffusion. However, for field strengths up to 1000 V/cm and a mean aerosol particle radius of 0.65 micron, diffusion is the decisive mechanism.

3230 APTIC NUMBER 20613

Dowling, Jerome M.
LINE WIDTHS IN THE PURE ROTATIONAL SPECTRUM OF CARBON MONOXIDE. Aerospace Corp., El Segundo, Calif., Space Physics Lab., Air Force Contract F04701-69-C-0066, SAMSO-TR-69-305, Aerospace TR-0066(9260-01)-4, 25p., Aug. 29, 1969. 20 refs.
CFSTI, DDC: AD 695457

Self-broadened semi-halfwidths of the pure rotational lines J equal to (7 less than six) through J equal to (20 less than 19) were measured for carbon monoxide, assuming a dipole moment of 0.112 Debye. These widths are narrower than those determined from vibration-rotation bands. The semi-halfwidth decreases anomalously from the J equals (9 less than 8) to the J equals (10 less than 9) transition. The measurements were derived from data obtained with a double-beam, lamellar-grating (two-beam) interferometer. The experimental conditions and methods of analysis are summarized. Since the corrections applied to the experimental data are different from those applied in conventional spectroscopy, an evaluation of these corrections is included. The measured semi-halfwidths are compared with the theoretical calculations obtained by previous investigators. Experimental problems encountered in using two-beam interferometric instruments to measure line widths are discussed. (Author abstract modified)

3231 APTIC NUMBER 20480

Duffy, A. P. and J. Dainora
CONSIDERATIONS FOR LNG PIPE MATERIAL SELECTION. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 19p. 17 refs. (April 7-12, Session no. 6, Paper #2.)

Fracture toughness data are discussed from both initiation and propagation viewpoints in the expected range of liquefied natural gas (LNG) pipeline temperatures and pressure. The temperature profile can be expected to range somewhere between the liquefaction temperature on natural gas at atmospheric pressure (-260 F) and the critical temperature (-116 F) above which liquid cannot be maintained; but the actual temperature profile depends upon transmission distance and the amount and type of insulation used. A pressure vessel is created and notched, and timing wires are spread along the pipe to measure fracture speeds. Thermocouples are mounted on the pipe, and the test specimen is filled with liquid nitrogen leaving a small gap to accommodate increase in volume and storage energy under pneumatic pressure. The critical stress intensity factor, Kcr, can be calculated from test data and, holding Kcr constant, the critical crack length versus failures stress curve is obtained. Fracture propagation depends upon the type or nature of fracture and the decomposition characteristics of the pressuring medium. In a subcooled system, it is possible for local stress to decrease abruptly while the fracture is in the process of accelerating; thus the crack is prevented from propagating.

3232 APTIC NUMBER 21138

Duffy, A. P., J. P. Sorenson, P. E. Wesloh, and F. L. Smith
HEAT TRANSFER CHARACTERISTICS OF BELOWGROUND LNG STORAGE. Chem. Eng. Progr., 63(6):55-61, June 1967. 9 refs.

Heat transfer characteristics are presented for a model 1285-bbl prestressed, insulated underground liquefied natural gas storage tank and a planned 600,000-bbl commercial unit. Special attention is given to the evaporation rate as a function of time and the timewise position of the freezing isotherms. The 32 F freezing isotherm progressed out through the soil at an average rate of 0.024 in/hr during the first 180 days of operation of the model tank. After this period, as the liquid level was gradually reduced to 3 ft, the progress of freezing slowed down and stopped completely at 240 days. The maximum distance of freezing was 11.1 ft from the side of the tank at 240 days. In the last 60 days of operation, a heating cable system effectively raised the 32 F isotherm from 9.1 to 1.6 ft below the tank. For a full tank (26-ft level), the loss rate two months after cooldown was 1.81%/day; loss rate 63 to 146 days after cooling was 1.81 to 1.72%/day. It increased slightly at subsequent reduced liquid levels, and at a greater rate when the soil heater was on. Calculated and measured loss rates are in close agreement, but the measured isotherm propogation values are 15% less than calculated values. The difference is attributed to latent heat given off while the water in the soil is frozen. Computer-simulated loss rate and freezing line for the commercial unit after four years are, respectively, 0.069%/day and 28.8 ft. However, heat transfer calculations for the same tank give the loss rate as 0.05#%/day

and the freezing distance as 51 ft. Thermal stratification in large LNG tanks does appear to be possible; thus boiling due to vapor pressure reduction is limited to a small surface layer.

3233 APTIC NUMBER 20938

Edstrom, T. and I. C. Lewis
RESEARCH AND DEVELOPMENT ON ADVANCED GRAPHITE MATERIALS. SUPPLEMENT TO VOLUME X - THERMAL REACTIVITY OF AROMATIC HYDROCARBONS. National Carbon Co., Parma, Ohio, Research Lab., Contract AF 33(616)-6915, Proj. 7350, Task 735002; Proj. 7381, Task 738102; and Proj. 7-817, WADD TR 61-72, 62p., Aug. 1968. 11 refs.
DDC: AD 606973

This supplement extends the survey of thermal reactivity of 88 aromatic hydrocarbons given in Vol. X (WADD 61-72) to 26 new aromatic hydrocarbons, 25 heterocyclic compounds, 76 substituted aromatics, and 14 binary mixtures of aromatic compounds. Differential thermal analysis (DTA) was employed to delineate the thermal behavior during pyrolysis to 750 C in an argon atomsphere. Emphasis is on the role of heteroatoms and the effects of ring substituents on the thermal reactivity of aromatic hydrocarbon precursors to carbon and graphite. The conclusions given in Vol. X are verified: (a) the carbonization reactivity of polycyclic aromatic hydrocarbons at atmospheric pressures is dependent on a combination of physical and chemical reactivity criteria; (b) additional structural features such as the presence of olefinic side chains or alkyl and aryl substitutents lead to enhanced carbonization reactivity; and (c) physical size can ameliorate the chemical effects, especially in borderline cases. In addition, heterocyclic compounds are more refractory than the analogous aromatic hydrocarbons, and substituent groups containing nitrogen, oxygen, sulfur, or halogens increase the reactivity of most polynuclear aromatics significantly. The substituent effect is related to the nature of the substituent with NO2, NH2, OH, and C double bond O groups being particularly effective. The position of reactivity can alter the extent of reactivity and can apparently affect the type of carbon product as well. Examples of both additive and nonadditive behavior of several types were provided by the experimental work; these are outlined. The report includes a brief description of the DTA apparatus, analytical procedures including chromatography and infrared and ultraviolet spectroscopy, and a full presentation and discussion of experimental results. (Author conclusions modified)

3234 APTIC NUMBER 21139

Flanagan, Donald A. and Paul B. Crawford
HOW FEASIBLE IS UNDERGROUND STORAGE OF LIQUEFIED METHANE? Am. Gas J., vol. 187:34-37, Oct. 1970.

A study was made of the feasibility of storing liquid methane at low pressures in underground caverns. Methane liquefies at -258 F at atmospheric pressure. Methane evaporation rates will rapidly decrease and cool the surrounding rock so that at the end of one month the rate would be 50 Mcf per hr for a cavern with a 25-ft radius and 700 Mcf per hr for a cavern with a 100-ft radius. At the end of 10 years, the evaporation rates would be 18 and 100 Mcf per hr, respectively, for the same caverns. The evaporation rates can be reduced by a factor of 2 to 10 by the application of insulation. The cost for mining the caverns is estimated to be $0.75 to $1.25 per Mcf of storage. This is substantially less than surface storage, while it is believed that contamination would be very small. (Author abstract modified)

3235 APTIC NUMBER 20260

Foitzik, L. and D. Spaenkuch
LOGARITHMIC GAUSSIAN DISTRIBUTION OF ATMOSPHERIC AEROSOL. EXTINCTION AND SCATTERING. (Logarithmische Gauss-Verteilungen beim atmosphaerischen Aerosol. Extinktion und Streuvorgaenge). Text in German. Z. Meteorol., 21(5-7):136-145, 1970. 16 refs.

It is possible to describe the size distribution of the atmospheric aerosol by logarithmic Gaussian distributions or by combinations of them. The spectral extinction, the scattering function, and the polarization function of each of the logarithmic Gaussian distributions can be described as the analogous size for monodisperse systems. The corresponding data are available in the form of Tables.

3236 APTIC NUMBER 20358

Fujiwara, M.
CALCULATIONAL METHODS OF EFFECTS OF HEIGHTS. (Yukoentotsudaka no kanisanteiho ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):74, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The Air Pollution Control Law effective as of Dec. 1, 1968 determines the emission standard for sulfur oxides according to the effective height of the emission source (stack). The mathematical equation for the emission standard as well as the effective height of the stacks are presented. Effective height is defined as the actual height plus the additional distance covered by the gas emitted with the upward momentum and the bouyancy due to the temperature differential. In order to simplify the calculation of the effective height, a graphical method is presented.

3237 APTIC NUMBER 20962

Furuyama, Shozo, David M. Golden, and Sidney W. Benson
THE THERMOCHEMISTRY OF THE GAS-PHASE EQUILIBRIUM 2CH3I IN EQUILIBRIUM WITH CH4 + CH2I2. THE HEAT OF FORMATION OF CH2I2. J. Phys. Chem., 72(13):4713-4715, Dec. 1968. 5 refs.

The heat of formation of CH2I2 was determined from a study of the gas-phase equilibrium 2CH3I in equilibrium with CH4 + CH2I2. Visible and ultraviolet absorption data were obtained for iodine and iodomethanes in the gas phase at 250-300 deg, while equilibrium

constants for the reaction 2CH3I in equilibrium with CH4 + CH2I2 were obtained at 332 and 278 deg. 'Third-law' values of the heat of formation were determined from combinations of the equilibrium constants obtained with entropy of formation as calculated from the literature on the entropies of the compounds. The heat of formation of CHI3 in the gas phase was 59.8 kcal/mol. In the experiment, (CHI3)e/(CH2I2)3 was usually around 0.0001, which was too small to effect the measurements of CH2I2.

3238 APTIC NUMBER 21410

Gelb, G. H. and W. A. Martin
AN EXPERIMENTAL INVESTIGATION OF THE FLOW FIELD ABOUT A SUBSONIC JET EXHAUSTING INTO A QUIESCENT AND A LOW VELOCITY AIR STREAM. Can. Aeron. Space J., 12(8):333-342, Oct. 1966. 24 refs. (Presented at the CASI/AIAA Low Speed Flight Meeting, Montreal, Canada, Oct. 18, 1965.)

The jet flow below a circular disc was investigated at various jet diameters above a ground board. Similarity of the velocity distributions in both the free and ground jets was uneffected by nozzle velocity or the presence of the disc except for very low nozzle-to-surface distances, in which case the circular disc drastically affected the radically spreading ground jet. The interaction of the jet directed into a low velocity air stream was also investigated. Experiments were conducted in an open-return wind tunnel. Pressure distribution on the disc varied with disc-to-ground height, but could be explained on the basis of three flow regimes produced. Using the experimental results as a guide, these pure jet flows were simulated by an electrical analogy. (Author summary modified)

3239 APTIC NUMBER 20458

Gensler, William G. and Gaylord W. Penney
AN EXPERIMENTAL METHOD OF PARTICLE TRAJECTORY ANALYSIS IN ELECTROSTATIC PRECIPITATION. IEEE (Inst. Elec. Electron. Engrs.) Ind. Gen. Appl. Group, 3rd Conf. Dec., 1968, p. 41-56. (Sept. 29-Oct. 3.)

A stroboscopic photographic system was developed and used to examine particle trajectories in the inter-electrode region of a model electrostatic precipitator. The model structure consisted of an entrance duct, an exit duct, a main duct which housed the precipitating electrodes, and a recirculating channel. The camera was arranged to accept forward scattered light from the particle. The forward scattering angle was kept as small as possible (at 30 degrees). Three seconds after the particles were placed into the injection air stream, the camera shutter was opened and the strobotron flashed. The camera shutter remained open for one second; 150 seconds were allowed to elapse for the next picture taking sequence. The energy for the strobotron was drawn from a 2 mfd capacitor. An optical beam control array produced a sharply defined area of illumination 3/4 inches high and 11/2 inches wide which helped to minimize the scatter from the plate electrode and surfaces in the vicinity of the electrodes. The devices used and the arrangement of the equipment were adequate for observing trajectories of particles as small as 5 to 10 micron in diameter. The particles could be examined throughout the inter-electrode space, from the wire down to the surface of the plate. Forward scattered light worked well with translucent particles (silica or alumina) but not for opaque particles (granular aluminum and flyash). Randomness and isotropism characterized particle movement. No evidence of rotation was found as the particle approached the plate for 75-88 micron silica, 149-177 micron silica, 149-177 micron flyash, or 149-177 micron granular aluminum. There was strong rotation when 75-88 micron and 149-177 micron silica rebounded after impact on the plate electrode both with and without corona.

3240 APTIC NUMBER 21053

Gleason, W. S., A. D. Broadbent, W. Whittle, and J. N. Pitts, Jr. SINGLET OXYGEN IN THE ENVIRONMENTAL SCIENCES. IV. KINETICS OF THE REACTIONS OF OXYGEN (1 DELTA G) WITH TETRAMETHYLETHYLENE AND 2,5-DIMETHYLFURAN IN THE GAS PHASE. J. Am. Chem. Soc., 92(7): 2068-2075, April 8, 1970. 14 refs. Part III. Environ. Sci. Technol., vol. 3:946, 1969. (Presented at the Symposium on Toxicologic and Epidemiologic Bases for Air Quality Criteria, 62nd Annual Meeting, Air Pollution Control Association New York, June 1969 and the Symposium on Chemical Reactions in Urban Atmospheres, General Motors Research Laboratories, Detroit, Mich., Oct. 6, 1969.)

Electronically excited molecular oxygen generated in a microwave discharge was treated in the gas phase with tetramethylethylene (TME) and 2,5-dimethylfuran (DMF). Infrared spectra and glpc analysis of the gas stream showed that under suitable conditions, the reactions of the excited oxygen with TME and DMF give essentially 100% yields of 2,3-dimethyl-3-hydroperoxy-1-butene(2) and the ozonide 2,3,7-trioxa-1,4-dimethylbicyclo +2.2.1]-5-heptane (4), respectively. The quenching of the excited oxygen was predominately chemical, forming the hydroperoxide. However, both physical and chemical quenching were observed in the oxygen-DMF system at about the same rate. Mechanistic implications of these results are discussed. (Author abstract modified)

3241 APTIC NUMBER 20774

Gonzalez, Richard D. and David E. Audette
HNO AS AN INTERMEDIATE IN THE CATALYTIC REDUCTION OF NITRIC OXIDE. J. Catalysis, 17(1):116-118, April 1970. 9 refs.

The catalytic reduction of nitric oxide by the addition of hydrogen atoms generated in the gas phase was studied on silica gel at 77 K. Following reaction, the products were analyzed for nitrous oxide by gas chromatography, nitrogen and water being identified indirectly. The hydrogen uptake was in excess of that required for 100% conversion of nitric oxide to nitrous oxide. When plotted as a function of percent conversion, the ratio of nitrous oxide to hydrogen uptake was found to approach unity at low conversion and decrease steadily as the conversion increased. Adsorbed nitrous oxide exposed to hydrogen atoms showed no reaction. To investigate the stability of the intermediate,

desorption rates were obtained for the addition product and nitrous oxide, then compared to the rates obtained for an equivalent amount of nitrous oxide adsorbed on the silica gel. The rate of desorption of adsorbed nitrous oxide is much faster than that for the addition product. The intermediate is most likely the dimer of HNO and nitrous oxide is probably formed on warm-up. High yields of nitrous oxide at low temperatures are probably due to the stability of (HNO)2, a likely precursor to the formation of N2O.

3242 APTIC NUMBER 20453

Gott, Preston P. and Alan P. Downs
AN ANALYSIS OF LABORATORY METHODS OF MEASURING SCATTERING PARAMETERS WHICH CHARACTERIZE OBSCURATION EFFECTS OF AEROSOLS. Ballistic Research Labs., Aberdeen Proving Ground, Md., Proj. 1T562603A286, MR-2004, 44p., Aug. 1969. 26 refs.
CFSTI, DDC: AD 693782

If an aerosol is introduced between an observer and an object of interest, the apparent contrast between the target and background will decrease. The mechanism of contrast reduction depends on meteorological conditions, the testing geometry, and the way radiation interacts with the aerosol. Some previous approaches, e.g. Watson and Kibler's measurement of the obscuring power of about 50 smoke clouds, Ohlhaber and Simonson's transmission measurements for white light and laser radiation plotted as function of aerosol concentration, and Forsthaff and Desjardins measurement of light flux at various locations in a chamber after fog oil aerosol had been introduced, lacked versatility and nonspecification of the basic parameters. The approach offering the greatest potential is to pass a collimated beam through an enclosed chamber containing the aerosol and take measurements of relevant properties of the aerosol and the environment in the chamber. The radiation originating at the target and background will be attenuated in passing through the aerosol. The contrast will be changed because of the scattering of radiation into the field of view. A test chamber is proposed consisting of a cubical box of polished plate glass panels. Two circular holes in the centers of two opposite sides accomodate the beam projection apparatus and the stationary photometer. The utilization of the data obtained with the chamber to answer tactical problems is described.

3243 APTIC NUMBER 21389

Grahame, David C. and Barbara A. Soderberg
IONIC COMPONENTS OF CHARGE IN THE ELECTRICAL DOUBLE LAYER. J. Chem. Phys., 22(3):449-460, March, 1954. 17 refs.

The rate of change with concentration of the capacity of the electrical double layer on mercury has been measured. From this the excess of cations in the double layer and the excess of anions have been calculated. The latter has been subdivided into the excess of anions in the diffuse double layer, and the excess of anions in the inner part of the double layer. From these data it has also been possible to evaluate the potential of the outer Helmholtz plane. It is found that fluoride ion remains unadsorbed on mercury at all potentials investigated, including potentials anodic to the e.c.max. Other anions are strongly adsorbed (chemisorbed) when the mercury is positively charged, and sometimes even when it is negatively charged. The "hump" in the capacity curves of salts of such anions as chloride, bromide, acetate, and nitrate, are found to be present in curves of the capacity attributable to anions alone. No chemisorption of monatomic cations could be detected. The kinetic theory of the diffuse double layer with constant dielectric constant is found to fit the experimental results within the expected accuracy. This fit extends to electrolytes of the 1:2 and 2:1 types also. A new method of evaluating salt adsorption at the potential of the electrocapillary maximum (e.c.max.) is described and results are given. Likewise a new method of determining the capacity attributable to cations at the e.c.max. is described and used. (Author abstract)

3244 APTIC NUMBER 21388

Greenwood, N. N. and R. L. Martin
THE ELECTROCHEMISTRY OF BORON TRIFLUORIDE CO-ORDINATION COMPOUNDS. PART VII. DEGREES OF IONIC DISSOCIATION IN THE MOLTEN STATE. J. Chem. Soc., Part 2:1427-1432, May 18, 1953. 19 refs.

Evidence is presented which unequivocally establishes that the electrical conductivity of molten boron trifluoride complexes is due entirely to self-ionic dissociation of the co-ordination compounds. The percentage of ions free to conduct in a melt is shown to be numerically equivalent to the reduced conductivity, provided that the ratio of the activation energies of viscosity and conductivity, is unity. This leads to values of the order of 10% for the degree of dissociation of the hydroxyl-containing complexes of boron trifluoride with water, alcohols, and acids, and 0.1% for the complexes with ethers, esters, and tertiary amines. The conduction characteristics of boron trifluoride complexes are compared with those of molten alkylammonium picrates and fused inorganic halides, to emphasize the conditions under which the calculations of the degree of ionic dissociation are valid. (Author abstract)

3245 APTIC NUMBER 21035

Guilleux, M.-F. and B. Ismelik
A STUDY OF THE MECHANISMS OF DECOMPOSITION OF N2O ON NIO. II. ADSORPTION AND DECOMPOSITION OF THE REAGENT. Etude des mecanismes de decomposition de N2O sur NIO. II. Adsorption et decomposition du reactif). Text in French. Bull. Soc. Chim. France, no. 4:1310-1316, April 1970. 13 refs.

The adsorption and decomposition of nitrous oxide on Nickel oxide were studied between 20-200 C and at 100 torr of N2O. Of the two samples of NiO used, one (A) was close to its stoichiometric state and the other (B) was previously saturated with oxygen. Decomposition of nitrous oxide occured from 20 C, at the same time as its chemisorption for which the activation energy is 8 Kcal/mole. Between 100-180 C, the amounts of nitrogen produced during composition are lower on NiO (A) than on NiO (b); the

converse is true above 180 C. Moreover, for a sample of NiO (A), readsorption of oxygen produced by the catalytic decomposition is observed at 100-180 C. In interpreting the data obtained, the configuration of the crystal field at the surface of nickel oxide was considered. The successive steps of the decomposition reaction are different according to the crystallographic planes studied. The rate-limiting step of the raction could be desorption of oxygen adsorbed O(-ads) on the (100) and (110) planes of the lattice of nickel oxide. (Author abstract modified)

3246 APTIC NUMBER 20597

Hampl, Vladimir, Zdenek Pelzbauer, and Kvetoslav Spurny
MEASUREMENT OF THE PORE CHARACTERISTIC OF MEMBRANE FILTERS.
Staub (English translation from German of: Staub, Reinhaltung Luft), 29(6):33-37, June 1969. 21 refs.

Because the efficiency of membrane filters with regard to filtration is, among other things, a function of mean pore radius and the pore size distribution, the determination of pore size is of interest. However, while surface pores have been frequently investigated, existing data on inner pores is mostly only qualitative. For these reasons, the inner morphology of membrane ultrafilters was evaluated quantitatively by electron microscopy. The results were compared with the mean radius determined by indirect methods (mercury porosimetry; the Frbe method; and measurements of gas flow rates, inner pores, and surface pores). A comparison of the results indicated that mean pore radii as determined by electron microscopy were smaller than those obtained by indirect method. On the basis of the measured values, correction curves were then plotted which permitted the average pore radius for filtration to be calculated from the data obtained by indirect methods.

3247 APTIC NUMBER 21136

Hanby, V. I.
THE EFFECT OF GASEOUS OSCILLATIONS ON THE COMBUSTION RATE OF SOLID FUEL PARTICLES. Fuel Soc. J., Univ. of Sheffield, vol. 18:48-59, 1967. 11 refs.

Data from the literature and the results of an experimental investigation are presented to show that combustion rates of solid fuel particles can be increased by the effects of sound fields in two ways: by the creation of acoustic vortices with low amplitude pulsations, and by the aerodynamic scrubbing effect of high amplitude pulsations. Increases in combustion rates due to aerodynamic scrubbing are higher than those due to vortex formation. Under aerodynamic scrubbing conditions, the total combustion rate of the coal is increased more than the volatile combustion rate. Very high combustion intensities (10 to the sixth power Btu/cu ft/Hr) can be obtained for pulverized fuel by the utilization of the high amplitude sound field produced by pulsating combustion. The findings are especially relevant to the large furnaces used in the power-generating industry. (Author conclusions modified)

3248 APTIC NUMBER 21164

Hashemi, M. T. and C. M. Sliepcevich
HEAT LEAK TO IN-GROUND STORAGE OF LNG. Chem. Eng. Progr., 63(6): 68-72, June 1967. 2 refs.

An accurate knowledge of boiloff rate as a function of time is essential in the economical design of natural gas liquefaction and in-ground storage facilities. The dominant source of boiloff throughout the life of the storage is the heat absorbed by liquefied natural gas in contact with wetted surfaces of the storage reservoir; this heat transfer is strongly time dependent since the surrounding ground continuously undergoes changes in temperature. Uncertainties about the actual temperature conditions at the exposed surfaces of the ground and about the thermal properties are the major source of inaccuracy in boiloff prediction. To provide a better understanding of the temperature habits of a typical in-ground storage cavern, the results of a numerical solution to the heat transfer problem are presented for a cavern with a depth-to-diameter ratio of 0.8. The ground around the storage consists of a horizontal soil layer extending to a depth of 0.8 radius, the remainder is made of a dry formation. Most of the results are in a dimensionless form to allow wider usage.

3249 APTIC NUMBER 17383

Hentz, Robert R. and D. B. Peterson
GAS-PHASE PHOTOLYSIS AT 1470 A OF MIXTURES OF CYCLOHEXANE WITH BENZENE AND WITH NITROUS OXIDE AT 750 TORR. J. Phys. Chem., 74(6): 1395-1396, March 19, 1970. 11 refs.

The formation of H2 in the 1470-A gas-phase photolysis of c-C6H12-C6H6 and c-C6H12-N2O mixtures was studied at 750 torr and at 95 deg. The results show no evidence of energy transfer from c-C6H12 to the potential acceptor N2O and demonstrate that H2 formation cannot occur from the same excited state of cyclohexane in both the gas and liquid photolysis at 1470 A. Presumably, H2 formation in the gas phase occurs from that state of cyclohexane produced by absorption of a 1470-A photon and H2 formation in the liquid phase from a lower, longer-lived state of excitation. It is concluded that both liquid and vapor emissions are molecular origin with the upper state being strongly predissociated in the vapor above approximately 7.7 e V.

3250 APTIC NUMBER 20534

Hidalgo, A. F. and Clyde Orr, Jr.
METHOD FOR PREDICTING THE PROPERTIES OF SUPERSATURATED SOLUTIONS OF THE ALKALI CHLORIDES. J. Chem. Eng. Data, 13 (1):49-51, Jan. 1968. 3 refs.

A guided extrapolation procedure based on osmotic coefficient data is described for estimating the solution partial pressure, the mean molal activity coefficient, and the activity of the solute for supersaturated solutions of alkali chlorides. Using

experimental osmotic coefficient data at 25 C, the ratio of coefficients were plotted for sodium chloride, potassium chloride, rubidium chloride, and cesium chloride in aqueous solutions relative to that of lithium chloride, and cesium chloride in aqueous solutions relative to that of lithium chloride as a function of the solution concentrations. The extrapolated values were incorporated in a computer program for predicting the properties of the electrolytes. The values obtained are estimated to be accurate to three significant figures at least to a concentration of 12 molal.

3251 APTIC NUMBER 20420

Hill, Arthur E.
REACTION OF AMINES WITH SULFUR DIOXIDE. I. ANILINE AND SULFUR DIOXIDE. J. Am. Chem. Soc., vol. 53:2598-2608, July 1931. 5 refs.

To determine the reaction between aniline and sulfur dioxide, samples of about 1 gram of Kahlbaum's aniline were weighed into the reaction vessel for each run. Glass beads were added to increase the surface. The sulfur dioxide was pumped in under slight excess pressure. From the volume, pressure, and temperature of the gas, the weight admitted to the system was determined. Initial absorption of the gas by aniline was very rapid, and equilibrium was reached within a few hours. Twenty-four hours were allowed to elapse before final manometer readings were taken. Sulfur dioxide dissolved in liquid aniline at 25 C up to a pressure of about 44 mm and a concentration of about 0.14 mole of gas per mole of aniline. At this concentration, the solid addition product appeared invariant upon further additions of SO2 until the aniline was completely converted into C2H5NH2-SO2. The abrupt rise in pressure at an absorption of 0.98 mole proves that the components combine in a 1:1 ration. The vapor pressures of the reaction product measured between 3.5 and 50 C yielded a curve which increased very steeply with the temperature. The pressure reached 760 mm at a temperature of 52 C. The heat of vaporization was calculated to be 19,630 cal. A diagram is given showing the effect of the three variables, temperature, pressure and composition, upon a compound having a congruent melting point. In the presence of water, aniline combines with sulfur dioxide to form a normal sulfite and an acid sulfite, both of which have dissociation pressures markedly less than that of the anhydrous reaction product.

3252 APTIC NUMBER 20632

Hiraoka, M. and T. Okubura
FUNDAMENTAL STUDY ON THE TOXIC GAS ADSORPTION PROCESS: ADSORPTION KINETICS OF SULFUR DIOXIDE AND OTHER GASES. (Yugaigasu no kyuchaku josoho process ni kansuru kisoteki kenkyu: aryusan gasu to no kyuchaku kiko). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):69, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

In order to supplement the basic research on the adsorption an solid-gas reaction mechanism, the adsorption volume and mechanism of sulfur dioxide gas on activated charcoal was measured under high temperatures. To measure the adsorption volume, a self-recording thermobalance was employed using the isobaric method. The experiment was conducted on the charcoal of prescribed characteristics at a specific range of sulfur dioxide gas pressure and at various temperatures in the interval of 100 - 150 C. At equilibrium, one gram of charcoal adsorbed 30.3 cc of sulfur dioxide, leading to the conclusion that the gas molecules form a simple layer on the adsorbent. By thermodynamic calculation, the adsorption was shown to be of physical nature even at a temperature as high as 150 C, and that the speed of adsorption is extremely high.

3253 APTIC NUMBER 20497

Holland, Alfred C.
THE SCATTERING OF POLARIZED LIGHT BY POLYDISPERSE SYSTEMS OF IRREGULAR PARTICLES. National Aeronautics and Space Administration, Cambridge, Mass., Electronics Research Center, NASA TN D-5456, 23p., Nov. 1969. 12 refs.

In an investigation of the theoretical aspects of light scattering by atmospheric aerosols, the elements of the Mueller matrix for polydisperse systems of irregular, randomly oriented particles were measured in absolute terms as a function of scattering angle for one wavelength. The recording polar nephelometer used for the measurements is described, as well as calibration procedures, particle dispersion system, signal processing, and data reduction. Results are compared to the matrix elements that were calculated for assemblies of sperical particles that fit the same particle size distribution function and have the same (real) refractive index. Correlations between the measured and calculated matrix elements are discussed. Within the limits imposed by the experimental conditions, it is concluded that the unpolarized mass scattering coefficient for a polydisperse system of irregular but randomly oriented particles shows a remarkable similarity to the corresponding coefficient for spherical particles, but that predicting backscattering for such particles on the basis of the spherical model can lead to serious errors; and that the particle dispersion system used in these experiments generates a scattering medium whose matrix exhibits the properties of an isotropic symmetric medium. (Author abstract modified)

3254 APTIC NUMBER 21254

Huckaba, C. E., N. Master, and J. J. Santoleri
PERFORMANCE OF A NOVEL SUB-X HEAT EXCHANGER. Chem. Eng. Progr., 63(7):78-80, July 1967. 13 refs.

A new type of heat exchanger utilizing the efficient transfer of heat between a two-phase, gas-liquid mixture and a fluid is described. In operation, a gas stream is forced through either a submerged orifice or a perforated distributor to produce a stream of bubbles which rise through the water bath to form a two-phase mixture. The heat transfer may be in either direction, but in either case, high rates of heat transfer are obtained with an extremely low net usage of water. Experimental evidence indicates that the major role of the air is one of effective

local agitation at the heat transfer surface. Once a high degree of agitation has been achieved, increased air flow produces little additional effect. Units in commercial operation are used in heating liquid ammonia at minus 28 F, vaporizing liquid nitrogen at minus 320 F, and vaporizing liquid natural gas at minus 260 F. In all cases, the outlet temperature is designed for 40-60 F.

3255 APTIC NUMBER 21137

Hwoschinsky, V.
CYROGENIC EQUIPMENT FOR LIQUEFACTION OF NATURAL GAS. Chem. Eng. Progr., 58(11):39-45, Nov. 1962.

Heat exchangers, expanders, and cyrogenic pumps associated with low-temperature liquefaction cycles are discussed. Aluminum longitudinal finned tube heat exchangers are suitable for low-pressure applications, when extensive surface area is not required. Spiral finned and wire wound tubes are appropriate for exchangers in high pressure service. A third alternative, useful if two high pressure streams and a low pressure stream are to be exchanged, is to bond two tubes together and then wind them with wire. Reciprocating expansion engines provide a convenient means of expanding relatively small flow volumes over large pressure ratios: a single cylinder may handle as much as 1000 std cu ft/min. Expansion engines have been built for handling air, nitrogen, helium, hydrogen, and methane and other hydrocarbons. Expansion turbines are used for flow volumes from 56,000 to more than 1,500,000 std cu ft/hr. Performance characteristics of impulse and radial reaction expansion turbines are graphically compared. Single- and two-stage centrifugal pumps are suitable for methane in the low- and medium-pressure ranges; high pressures are handled by a reciprocating single-acting plunger-type pump. The bulk of heat exchangers, liquid vapor separators, valves, and piping operating at low temperatures are installed in a cold box, with heat exchangers and separators mounted to utilize gravity flow. Perlite, or an equivalent, operating at essentially atmospheric pressure, is preferred insulation for large liquefiers. Suitable construction materials are ASTM grades 201 and 212 carbon steels. Alloys must be chosen to minimize heat leak.

3256 APTIC NUMBER 20916

Israel, Gerhard W.
INVESTIGATIONS OF AEROSOL BEAMS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(5):5-8, May 1969. 7 refs.

The collecting target in conventional particle collectors and/or separators is usually located one nozzle downstream from the jet orifice. The particle paths downstream from the nozzle depend primarily on the interaction of the air jet with the target. In an aerosol beam, however, the distance between the collector plate and the nozzle is very large compared to the nozzle diameter. The particle trajectories are essentially determined by the expanding air jet in the vicinity of the nozzle rather than by the interaction of the jet with the target. The relationship is described between beam width and particle size, particle density, source pressure, and nozzle geometry. Beams of polystryene latex and tungsten oxide particles from 0.013 to 1.3 micron diameter were generated by the continuous nozzle expansion of an air particle mixture. The nozzles were capillaries of 159 micron inner diameter and various lengths. The particles were collected from the beam on microscope cover glasses or on mesh electron microscope grids. The point at which the particle density decreased to 50% of its value near the center of the deposit was taken as a measure of beam width. A mathematical model is presented for relating beam width to the physical properties of the particles and the air jet. Except for 1.3 micron latex particles, the model satisfactorily describes the experimental measurements. It can be used for predicting beam expansion for capillaries of 160 micron inner diameter and a length greater than five mm.

3257 APTIC NUMBER 20491

Jackson, P. G. and M. Kotcharian
TESTING AND TECHNOLOGY OF MODELS OF INTEGRATED TANKS FOR LNG CARRIERS. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 11p. 5 refs. (April 7-12, Session no. 6, Paper 35.)

An integrated membrane system for liquefied natural gas (LNG) tankers is tested for fatigue characteristics based on a flexible, thin stainless steel primary barrier supported on a rigid balsa and plywood insulation and secondary barrier. The primary barrier has crossed corrugations with specially designed knots at the cross-over points and corners to accommodate thermal contraction and pressure variations due to ship's movements; the secondary barrier system is designed to act in case of leakage from the primary container and to prevent water leakage in the event that a crack develops in the inner hull. Thickness of insulation is chosen to limit heat flow to a rate which meets the required specifications of cargo evaporation loss, ensure a safe temperature of the inner hull for the material used, and to limit deformation resulting from applied loads to figures acceptable to the membrane. Test conditions are based on relationships between sea states and acceleration and deformation of ships, and 40,000 cu m is used to establish test criteria, as studies have shown this to be the most severe ship capacity. Stresses and strains are evaluated due to thermal origin, to cyclic elongation, cyclic variations of pressure, and irregularities of construction and tolerances. Fatique curves justify that a membrane design is satisfactory for use in all sizes of LNG carrier.

3258 APTIC NUMBER 21537

Jellinek, H. H. G., P. Plaisman, and P. J. Krysan
REACTION OF SO2 and NO2 WITH POLYMERS. J. Appl. Polymer Sci., vol. 13:107-116, 1969. 7 refs.

A number of polymers were exposed to sulfur dioxide and nitrogen dioxide in the presence of oxygen and ultraviolet light. Chain scission, crosslinking, and changes in infrared spectra were observed. All the polymers suffered from deterioration, which

may become considerable with exposure over long periods of time. Elastomers form a separate group, being more susceptible to SO2 and NO2 than saturated polymers; however, they are still more sensitive to ozone. (Author summary modified)

3259 APTIC NUMBER 21398

Johnson, J. E., F. J. Woods, and M. E. Umstead
CHEMI-IONIZATION DURING PLATINUM-CATALYZED OXIDATION OF HYDROCARBON VAPORS. In: Report of NRL Progress. Naval Research Lab., Washington, D. C., p. 16-22, Dec. 1969. 14 refs.
CPSTI: PB 188271

Studies are reported in which various hydrocarbon vapors were oxidized in the presence of a heated platinum filament. The yield of ions from the platinum-catalyzed oxidation of hydrocarbon vapors depends greatly on the molecular structure of the given hydrocarbon. The yield of ions was much greater from highly branched alkanes than from n-alkanes. In general, an increase of oxygen content in the gas mixture considerably enhanced the ion yield. With some hydrocarbons, however, the fraction of the material that was oxidized decreased markedly with increased oxygen concentration. An explanation that seems consistent with the data is that at lower temperatures (less than about 400 C), oxidation occurs only on the surface of the platinum, but at higher temperatures the catalytic process extends into the vapor phase. It is suggested further that at higher temperatures, dissociative adsorption of oxygen is involved in the ion-producing process. (Author abstract modified)

3260 APTIC NUMBER 21394

Johnson, P. C.
SATELLITE PEAKSHAVING SYSTEMS. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 11p. (April 7-12, Paper 4-18).

A peak shaving 'satellite' is proposed which would contain storage and vaporization facilities within trucking distance of a central liquefaction and storage plant for liquefied natural gas. LNG would be transferred from the primary tank at Eau Claire, Wisconsin, to the La Crosse tank by means of a highway transport LNG trailer. The loading facilities would consist basically of necessary piping, valves, pressure gauges, and hoses for safe and efficient transfer of LNG, as well as provisions for safe blowdown of the hoses before disconnecting. Send-out systems will automatically pump and vaporize liquid from the storage tank at rates up to 20 million standard cu ft per day: two identical centrifugal, multi-stage pumps will be provided, each designed to discharge 12 million standard cu ft per day of LNG to line pressure; two direct fired vaporizers will heat, vaporize and superheat the natural gas to pipeline conditions. Increased safety is to be provided by allowing only inert combustion gases from external burners to contact the tubes carrying natural gas. Indication of important variables such as pressures, levels and flows will be provided at a central control board, and certain malfunctions will safely shut down a plant. Functions of the primary facility are also described, as well as design criteria for both storage tanks.

3261 APTIC NUMBER 21029

Jones, I. T. N., U. B. Kaczmar, and H. P. Wayne
THE PHOTOLYSIS OF OZONE BY ULTRAVIOLET RADIATION. III. THE PHOTOLYSIS OF DRY OZONE/OXYGEN MIXTURES AT LOW PRESSURES IN A FLOW SYSTEM. Proc. Roy. Soc. (London), Ser. A, 316(1526):431-439, May 5, 1970. 18 refs.

The photolysis of dry ozone plus oxygen mixtures (90, 50, and 10% O3) was studied for partial pressures of ozone between 0.05 and 2 Torr with lambda equals 254nm. A flow technique was employed, and the extent of ozone decomposition was followed absorptiometrically. Over the pressure range investigated, the quantum yield was vertically independent of ozone pressure for any ozone plus oxygen mixture, and increasing dilution of the mixture from 90 to 10% ozone only slightly reduced the observed quantum yield. All quantum yields were near 4. The results are interpreted in terms of the formation of singlet molecular and atomic oxygen in the primary photochemical step; kinetic analysis of a hypothetical reaction scheme predicts quantum yields consistent with those observed. (Author abstract modified)

3262 APTIC NUMBER 21390

Jura, George and William D. Harkins
SURFACES OF SOLIDS. XIV. A UNITARY THERMODYNAMIC THEORY OF THE ADSORPTION OF VAPORS ON SOLIDS AND OF INSOLUBLE FILMS ON LIQUID SUBPHASES. J. Am. Chem. Soc., vol. 68:1941-1952, Oct. 1946. 32 refs.

At constant temperature the film formed by adsorption on a solid may undergo phase transitions as the pressure is increased, and each of the phases may be described by an equation which also represents accurately a single phase of an insoluble film on a subphase of water. N-heptane and ferric oxide and n-heptane on graphite exhibit in the pi-sigma-T relations all the phenomena associated with the critical temperature region of three-dimensional systems. In the study of the system with graphite as the subphase, the transition was obtained from the liquid expanded to the intermediate phases. The triple point of the gas-liquid expanded-liquid intermediate phase was located in this work, and it was shown that transitions from the gas phase are possible even above the critical temperature. For six solids it was found that at 15 deg a condensed film is formed at lower film pressures and higher molecular areas than at 25 deg. Since all the available evidence indicates that at temperatures below 0.7 of the three-dimensional critical temperature of the gas phase transitions occur, it is evident that non-gaseous phases must exist. The analysis given of the states of films extends as far as is possible with classical thermodynamics as related to their isothermal behavior; if a more explicit description is desired, it becomes necessary to construct a model and use the methods of statistical mechanics.

3263 APTIC NUMBER 20617

Kassner, J. L. JR., J. C. Carstens, M. A. Vietti, A. H. Biermann, Paul C. P. Yue, L. A. Allen, M. S. Eastburn, D. D. Hoffman, H. A. Noble, and D. L. Packwood
EXPANSION CLOUD CHAMBER TECHNIQUE FOR ABSOLUTE AITKEN NUCLEI COUNTING. J. Rech. Atmospheriques, 3(1-2):45-51, 1968. (Presented at the Meeting International de Comparaison des Generateurs et Compteurs de Noyaux de Condensation et de Noyaux Glacogenes, Centre de Recherches Atmospheriques, Campistrous par Lannemezan, France, Sept. 8-23, 1967.)

The number of condensation nuclei activated at a given supersaturation cannot be determined by means of a single expansion. Condensation on an unknown nucleus spectrum gives rise to an unknown reduction in supersaturation caused by droplet growth which takes place during the expansion itself. An accurate count may be obtained by developing the nucleus spectrum by means of a series of expansions to successively higher supersaturations. Moreover, the correction factors can be greatly reduced by diluting the nuclei sample. A cloud chamber is described which makes use of the most advanced cloud chamber technique. The technique utilized offsets the would-be increase in temperature at the center of the chamber due to wall effects and maintains a constant pressure. The chamber gives accurate Aitken nuclei spectra and is particularly useful for calibrating Nola, Pollak, and Gardner field counters. (Author abstract modified)

3264 APTIC NUMBER 21632

Kessel'man, P. M., M. M. Afanas'yev, A. S. Restuzhev, Yu. I. Blank, S. P. Gorykin, P. A. Kotlyarevskiy, S. K. Chernyshev, and S. A. Shchekatolina
HEAT CAPACITY OF GASES AT ELEVATED TEMPERATURES WITH ACCOUNT OF THEIR NONIDEALITY AND THERMAL DISSOCIATION (H2O, CO2, F2, AIR, LITHIUM AND FUEL COMBUSTION PRODUCTS). Teplo- Massoperenos, vol. 7, 1968. 6 refs. Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div., p. 152-157, Aug. 20, 1969.

A method of calculating the heat capacities Cp and Cv of chemically reacting gases is considered which takes into account their nonideality. Deviation from nonideality, when calculations are made of properties of pure components, equilibrium compositions, and compositions of mixtures, is allowed for by the second and third virial coefficients, which ensures adequate precision of results for the entire range of parameters investigated. Calculations of equilibrium compositions are carried out by solving a system of nonlinear algebraic equations, a specific form of which is determined in the individual case by the equations of the corresponding chemical reactions, equations of material valance of atoms, and the condition (Sigma) xi equals 1. Since in the general form, solution of this system does not appear possible, equilibrium compositions were determined by the iterative method on an electronic digital computer at specified values of T and p. This method is applicable to the calculation of detailed tables of isobaric and isochoric heat capacities for water vapor, carbon dioxide, fluorine, air, lithium, and the combustion products of 13 organic fuels throughout the entire range of temperatures and pressures of practical importance (up to 6000 K and 0.1-1000 bar). An example is given for the isobars of the specific heat capacity Cp for one of the most complex systems of the groups under study (combustion products of a stoichiometric mixture of Saratov gas and air).

3265 APTIC NUMBER 21631

Kessel'man, P. M. and A. S. Litvinov
VISCOSITY AND THERMAL CONDUCTIVITY OF COMBUSTION PRODUCTS OF ORGANIC FUELS. Teplo- Massoperenos, vol. 7, 1968. 17 refs. Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio, Technology Div., p. 127-139, Aug. 20, 1969.

The theory for the statistical mechanics on nonequilibrium systems, which gives an expression for the viscosity and thermal conductivity of single-atom gases and their mixtures, is applied to multi-atomic gases and mixtures, taking into account the influence of internal degrees of freedom, to calculate viscosity and thermal conductivity of combustion products of fuels. After deriving the mole fractions of components and component coefficients of viscosity, the coefficients of viscosity of the combustion products of 12 fuels were calculated in the temperature range 400-6000 K and the pressure range 0.1-100 bar. Calculation of thermal conductivity was made for the same fuels, oxidizers, coefficients of oxidizer excess, and pressures and temperatures as for viscosity. Examples from the calculations of both viscosity and thermal conductivity are given for Saratov gas. In contrast to the viscosity, the coefficient of thermal conductivity varies sharply as a function of pressure and temperature (when temperature is greater than 2000 K). This is accounted for by the change in the composition of the fuel combustion products as a result of dissociation and formation of new molecular species.

3266 APTIC NUMBER 21080

Kozyrev, B. P. and V. A. Bazhenov
THE ROLE OF MINOR ATMOSPHERE ADMIXTURES IN THE ABSORPTION OF INFRARED RADIATION. Izv. Akad. Nauk SSSR, Fiz Atmosfery i Okeana, 5(7):738-748, 1969. 3 refs. Translated from Russian by Ludmilla D. Fedine. Volt Information Sciences, Inc., Lanham, Md., 9p., Aug. 1969.
CFSTI: N69-36448

The role of minor atmospheric gas components (nitrous oxide, methane, and carbon monoxide) in the absorption of infrared radiation is discussed from various points of view. The unavailability of practical methods of computation is emphasized. The transparency of minor atmospheric admixtures is plotted as a function of W/Wo and the errors of calculation are evaluated. The computation of transparency of different air masses at the centers of the N2O, CH4, and CO absorption bands attests to the significant role of minor atmospheric components in the weakening of infrared radiation. (Author abstract modified)

3267 APTIC NUMBER 20419

Kulcsar, Geza J. and Gyorgyi Lengyel-Szabo
STUDY OF THE SYSTEM SULFUR DIOXIDE-ANILINE, PART III. ABSORPTION ISOTHERMS IN AQUEOUS SOLUTION. (Studiul sistemului bioxid de sulf-anilina (III). Izotermele de absorbtie in solutie apoasa). Text in Romanian. Studia Univ. Babes-Bolyai Ser. 1, 9(1):77-83, 1964. 3 refs.

Studies of the absorption isotherms of sulfur dioxide in aqueous solution of aniline were carried out in 3% and 9% aniline solutions at temperatures between 25 and 60 deg. The degree of absorbing solution increases almost proportionally it its aniline concentration. During the first phase of scrubbing, the rate of absorption grows with increase of temperature (up to 60 C), while the gases generated have a final nitrogen dioxide content that is much lower than at lower temperatures.

3268 APTIC NUMBER 20594

Kuratsune, Masanori and Tomio Hirohata
DECOMPOSITION OF POLYCYCLIC AROMATIC HYDROCARBONS UNDER LABORATORY ILLUMINATIONS. Nat. Cancer Inst. Monograph, no. 9:117-133, 1962. 3 refs. (Presented at the Symposium on the Analysis of Carcinogenic Air Pollutants, Cincinnati, Ohio, Aug. 29-31, 1961.)

A study was undertaken to determine whether decomposition of polycyclic aromatic hydrocarbons occurs under the ordinary conditions of laboratory illumination. Benzo(a)pyrene and 7,12-dimethylbenz(a)anthracene were dissolved in purified cyclohexane and irradiated by ultraviolet light. After similar irradiation periods of roughly 40 hours, 25% of the benzo(a)pyrene and 84% of the 7,12-dimethylbenz(a)anthracene had decomposed. Fourteen aromatic hydrocarbons were irradiated by daylight-type fluorescent lamps. Among the hydrocarbons tested, naphthacen was most sensitive: 47% had decomposed after 41 hours of irradiation. No other compounds showed appreciable decomposition after 80 hours of irradiation. The effects of other types of illumination and solvent were also examined. These results should be considered whenever aromatic hydrocarbons are handled under fluorescent lamps, or even in sunlight. It is emphasized that prolonged exposure to these artificial and natural illuminations may cause serious destruction of the hydrocarbons; only transient exposure may not. When aromatic hydrocarbons are exposed to a strong ultraviolet light generated by a mercury vapor lamp, precautions should be taken. Presence of oxygen affects the photochemical degradation of aromatic hydrocarbons a great deal. Simple saturation of their solutions with N2 does not guarantee satisfactory protection against degradation. (Author abstract modified)

3269 APTIC NUMBER 20469

Lake, R. L., F. W. DeMoney, and R. J. Eiber
PERFORMANCE OF 5083 AND 7039 ALUMINUM ALLOYS IN VESSEL BURST TESTS AND NOTCHED TEST PANEL TESTS AT -220 F. (Inst. of Gas Technology, Chicago, Ill., Proc. Interm. Conf. LNG, 1st, Chicago, Ill. 1968, 21p. 8 refs. (April 7-12, Session no. 5, Paper 26.)

Aluminum alloys 5083-0 and 7039-T61 were studied by linear elastic fracture mechanics for capability as pressure vessels intended to contain liquefied natural gas at -200 F. Fabricated for pressure tests were three bottle shaped vessels GMA welded from 1-inch thick 5083-0 plate and three GMA welded from three-fourths-inch thick 7039-T6151 plate. Pre-flaws, simulating through and part-through cracks, were cut into the material, and fracture toughness values were calculated from tests to destruction by internal pressurization with gaseous nitrogen after the iso-pentane filled vessel had been cooled from -210 F to -235 F by liquid nitrogen. Tensile tests of panels up to 12-inches wide with notches in the plate and weld were tested to -250 F and in some cases to -320 F. Both alloys are tolerant of quite large flaws at temperatures down to -220 F. and test data and a long service recorded indicate that carefully designed and constructed pressure vessels of 5083-0 can be operated at stresses considerably higher than the ASME Boiler and Pressure Vessel Code maximum. Alloy 7039-T6151, although less tough than 5083-0, can be used too at higher operating stresses, provided flaw sizes are small in the presence of yield stress fields. Toughness of the weld metal will generally determine the size of the smallest critical flaw. Temperature has very little effect on the static load-carrying ability of sharply notched panels in the range from room temperature to -320 F, and tests on panels of a size which can be handled in the average laboratory appear to be of little aid in obtaining quantitative toughness data on materials as tough as 5083-0 and 7039-T6151. Studies conclude that critical flaw lengths provide a valid, quantitative measure of the ability of a material to resist crack propagation in a given structure. (Author abstract modified)

3270 APTIC NUMBER 20439

Lantelme, Frederic and Marius Chemla
ELECTRIC MOBILITY OF Na(+) AND K(+) IONS IN THE MOLTEN KNO3 - NaNO3 SYSTEMS. (Mobilite electrique des ions Na(+) et K(+) dans les systemes KNO3 - NaNO3 fondus). Text in French. Bull. Soc. Chim. France, vol. 10:2200-2203, Oct.-Dec. 1963. 12 refs.

During previous experiments on isotope separation by electromigration in counter-current flow made on binary systems of bromides and nitrates of alkali metals, the mobilities of the two alkali-metal cations become equal at a definite composition of the mixture. Beyond that composition on either side, the mobilities of the two cations are inverted. In a recent study of the mechanism of ionic migrations in molten alkali-metal nitrates, the coefficients of autodiffusion of K(+) and Na(+) ions were measured in molten KNO3-NaNO3 mixtures at different temperatures. The present study supplements this work by measuring the respective electric mobilities. The electrolytic cell used for making these measurements is described. The mobilities of the constituent ions were determined by measuring with the aid of radioactive indicators their transport numbers between the anodic and cathodic compartment separated by a porous partition permeable to the ions but impermeable to any liquid. Potential sources of error were estimated in preliminary tests. The results of the mobility measurements at up to six different temperatures for KNO3-Na NO3 mixtures with 0,25,50,75, and 100% NaNO3 and are plotted. The

inversion of mobilities of K(+) and Na(+) ions at a definite composition of the mixtures varies considerably with the test temperature. In interpreting these findings, the Nernst-Einstein relation between mobility and diffusion coefficient of charged particles is used to support the view that, in the mixtures, the cations and anions form more or less loose associations.

3271 APTIC NUMBER 21068

Lesiewicz, Krystyna, Aleksandra Pudliszak-Dziewanowska, and Juliusz Wesolowski
POROUS STRUCTURE OF VANADIUM CATALYSTS FOR SO2 OXIDATION. (Struktura porowata katalizatorow wanadowych do utleniania SO2). Text in Polish. Przemysl Chem., 48(3):140-143, 1969. 2 refs.

Vanadium catalysts used to oxidize sulfur dioxide in the manufacture of sulfuric acid were studied in terms of their pore structure. The preferred catalyst had pores with a radius larger than 5,000 A. When 90% of the pores exceeded 1,000 A, the activity of the catalyst was fairly high, while lowest activity was assigned to those with a majority of pores below 1,000 A. For pores ranging in their radius from 75 to 75,000 A the specific volume was 0.12-0.65 sq cm/g. The range of specif surface was 2.8-6.1 sq m/g.

3272 APTIC NUMBER 21066

Law, Sidney Edward
CHARGE LOSS PHENOMENA ACTIVE ON LIQUID DROPLETS. North Carolina State Univ., Raleigh, Dept. of Biological and Agricultural Engineering, Thesis (Ph.D), Ann Arbor, Mich., Univ. Microfilms Inc., 1968, 165p. 59 refs.

The evaporative charge loss of liquid droplets, their charge loss due to hydrodynamic instability, and their gaseous discharge were studied, beginning with the measurement of values for individual droplets, which were generalized into statements concerning spray charge losses. There was no charge loss due to evaporation, either from charged water droplet surfaces or from large charged plane water surfaces. For droplets with a radius larger than 0.01 micron, the surface charge does not seem to affect the evaporation rate. Evaporation from a charged droplet or charged plane surface did not vary significantly in its rate from that of uncharged surfaces. A positive polarity test indicated that the same results could be expected from positive or negative polarity. Hydrodynamic instability probably accounts for a large charge loss from evaporating water droplets. Maximum charge was governed by hydrodynamic instability rather than by gaseous breakdown of a droplet. The data was applied specifically to the problem of greater control in the spraying of plants with insecticides. By a strict control of all operating parameters, the charge loss problem could be converted into a means of controlling charge-to-mass ratio of droplets as they are deposited on the plant surface, thus achieving optimum deposition and biological control. Electrical conductivity had no important effect on point-droplet discharge current for charge levels up to 55% of the Rayleigh limit. At 60% charge level, a highly conductive liquid gave a significantly larger discharge current. An unexpectedly high increase in gap current was found when the droplet charge was increased from 55 to 60%. For gaps of less than 0.030 inch, the droplets left the grounded point region with a reversed sign charge, indicating 'overneutralization'.

3273 APTIC NUMBER 21160

Lehman, Alexander, Edward Adler, Jacob Freidus, and Max Neimand
THE LIQUIDUS CURVE AND SURFACE OF THE SYSTEMS LITHIUM AND CALCIUM NITRATES AND CALCIUM, LITHIUM AND POTASSIUM NITRATES. J. Am. Chem. Soc., vol. 59:179-181, Jan. 1937. 12 refs.

In an investigation of the binary system lithium nitrate-calcium nitrate, temperature and time-differential temperature cooling curves were made on a number of melts. These curves show the eutectic temperature of the system to be at 235.2 deg, while the eutectic composition is at about 70% lithium nitrate. The liquidus surface of the ternary system calcium, lithium, and potassium nitrates was partially explored. The ternary eutectic temperature is 117.4 deg, and the eutectic composition is 15% calcium, 62% potassium, and 23% lithium nitrates. (Author summary modified)

3274 APTIC NUMBER 20883

Linden, Erik G. and Charles P. Lascaro
EXTRATERRESTRIAL PARTICULATES FROM ANTARCTICA. Army Electronics Command, Fort Monmouth, N. J., 20p., Dec. 1964. 13 refs.
CFSTI, DDC: AD 614408

The dielectric properties and physical nature of sediment obtained from snow melters used at South Pole Station were determined. The results were compared with similar data obtained by recent radar reflection studies of the lunar surface which have indicated a more compact surface than is popularly supposed. The Antarctic sediment is believed to contain an appreciable quantity of micrometeoric particles, or interplanetary dust, and may therefore resemble lunar dust. Samples were processed to remove terrestrial contaminants before electrical and microscopic studies were carried out. At the highest frequency, 200 mc/s, the dielectric constant of the compacted snow melter specimens, with a bulk density range of 0.464 to 0.618 g/cc, varies from 1.22 to 1.30. From radar reflection measurements of the moon's surface, its dielectric constant has been calculated to be about 3 at 440 mc/s. Assuming that the composition of the snow melter sample and the moon's surface are similar, then a clue is provided that the bulk density of the moon's surface may be higher than that of loose powder specimen. It is to be noted, however, that the dielectric constant of the moon's surface was determined at a higher frequency than was utilized in these tests and that the large difference in dielectric constant cannot be attributed solely to differences in measurement frequency. The possibility also exists that there are significant differences in physical structure and chemical composition between the snow melter sample and the moon's surface. (Author conclusions modified)

3275 APTIC NUMBER 20561

Liu, B. Y. H. and K. T. Whitby
THE ELECTRICAL CHARGING OF SMALL PARTICLES AT LOW PRESSURES. Minnesota Univ., Minneapolis, Particle Technology Lab., AEC Contract AT(11-1)--1248, 35p., Oct. 1968. 15 refs.

The electric charge imparted to particles at reduced pressures was measured for particles ranging from 0.02 micron to 2.0 micron and for pressures ranging from 0.01 atmosphere to 1.0 atmosphere with an improved particle mobility analyzer of cylindrical geometry. The solid spherical particles of methylene blue dye were charged by positive ions in electric fields of various intensities. The measured particle charge was generally higher than the values predicted by White's equations, and the difference increased with decreasing pressure. Typically, the measured charge at 0.01 atmosphere was 100% higher than the values predicted by the diffusion charging equation and was slightly less than one order of magnitude higher than what the field charging equation predicts. Theoretical calculations taking into account both the field and diffusion mechanisms of particle charging at low pressures were made. These calculations agreed quite well with the experimental data obtained at 0.01 atmosphere. However, the agreement was less satisfactory for the data obtained at higher pressures. (Author abstract modified)

3276 APTIC NUMBER 20930

Low, Richard D. H.
A COMPREHENSIVE REPORT ON NINETEEN CONDENSATION NUCLEI. (PART I - EQUILIBRIUM GROWTH AND PHYSICAL PROPERTIES). Army Electronics Command, Fort Monmouth, N. J., Task 1T061102B53A-20, R-ECOM-5249, 553p., May 1969. 8 refs.
DDC: AD 691709

The theoretical study of condensation nuclei was hampered by the fact that one must know the van't Hoff i-factors for a particular nucleus at different concentrations. As a result, only sodium chloride was studied extensively. A generalized expression for the solution effect on droplet growth is used, thus simplifying the study of the growth behaviors of a large number of promising condensation nuclei under equilibrium conditions. Tables are compiled to present their equilibrium growths and their physical properties, and a few graphs comparing these properties are included to illustrate how the data in these tables may be used. It is believed that the information will facilitate selection of the proper artificial nuclei for the modification of warm fogs and clouds, when combined with adequate measurements of the pertinent environmental parameters. (Author abstract modified)

3277 APTIC NUMBER 21582

Lusk, D. T. and D. C. Dorney
ADVANCEMENTS IN CONSTRUCTION AND PERFORMANCE OF ABOVEGROUND STORAGE TANKS FOR LNG. Preprint, Intern. Inst. Refrigeration, Paris, 5p., 1968. (Presented at the International Congress on Refrigeration, 12th, Madrid, Aug. 30-Sept. 6, 1967, Paper 17/990.)

During 1967, two large aboveground storage tanks for liquefied natural gas were put into operation in New York City and Memphis. Like other tanks under construction in Libya and Portland, Oregon, the installations incorporate advanced techniques of aboveground construction. Each is a double wall, double bottom facility, with an inner cylindrical tank of 9% nickel steel. The 9% nickel steel has transverse impact values of 20 ft-lbs, assuring cross rolling sufficient to eliminate directional properties. A ringwall foundation supports both the inner and outer shells of the Memphis tank, while heating coils underneath the tank bottom maintain a constant temperature of 40 F to prevent freezing and heaving of the supporting soil. the New York tank foundation consists of timber-composite piles with a reinforced concrete cap. The bottom of the pile cap is several feet above ground to permit circulation of air and thus keep the ground at ambient temperatures without the use of heating coils. The shell and roof insulation is expanded, loose fill perlite. A resilient blanket and a system of stiffeners compress or expand with tank-wall movement to prevent perlite compaction from occurring. The tanks for Libya and Portland substitute a flat non-gastight, suspended deck for a gastight, self-supporting dome roof. The suspended deck is supported by a series of rods attached to structural roof members. Insulation material on the deck is mineral wool, protected by natural gas. Although the inner cylindrical shell must still be still be designed for the external pressure exerted by the resilient blanket, it need no longer also accommodate a simultaneous gas pressure in the annular space.

3278 APTIC NUMBER 21466

Matveev, A. A. and O. I. Bashmakova
REMOVAL OF SOLUBLE SUBSTANCES FROM THE ATMOSPHERE AT THE SURFACE OF SMALL BODIES OF WATER. (Vynos iz atmosfery rastvorimykh veshchestv na poverkhnost' malykh vodoyemov). Text in Russian. Gidrokhim. Materialy, vol. 44:5-15, 1968. 8 refs.

Data on the chemical composition of atmospheric precipitation and soluble dust particles falling onto the surface of the Otkaznensk Reservoir, Stavropolsk Region, are reported for the summer of 1966. The monthly precipitation of eolian material was established at about 13 t/sq km, 30% of this amount being water soluble. This amount of deposition is about 1.5 times greater than for urban regions in this same geographic zone. Local factors such as soil dust, organic substances, and human activity were found to play a major role in determining the chemical makeup of the soluble materials present. Predominant ions detected were calcium(++), ammonium(+), and HCO3(-).

3279 APTIC NUMBER 20734

McDowell, C. A., H. Nakajima, and P. Raghunathan
ELECTRON SPIN RESONANCE STUDIES OF ORIENTED NO2 AND NF2 IN INERT

MATRICES AT LOW TEMPERATURES. Can. J. Chem., vol. 48:805-817, March 1, 1970. 18 refs.

Preferentially oriented nitrogen dioxide and nitrogen fluoride in inert matrices were studied in some detail by electron spin resonance methods at 4.2 deg K. Methods are discussed which may optimize the degree of preferential orientation of the paramagnetic species in appropriate matrices. The results demonstrate that, while neon is the best host matrix for orienting NO2, argon is preferred for NF2. The g-values and hyperfine splitting data were accurately determined and compared with earlier values. Rotional processes are suggested to explain the spectra obtained for NF2 in an argon matrix in the temperature range 4-30 deg K. (Author abstract)

3280 APTIC NUMBER 20349

ANALYSIS AND ESTIMATION OF AIR POLLUTION BY CARBON MONOXIDE. (Issanka-tanso ni yoru taiki osen no kaiseki to hyoka ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):17, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The basic approaches to data anaylsis and evaluation of air pollution do not differ for pollutants in general, but the conditions under which pollutants appear and their statistical anaylsis vary according to the differences in the emission sources as well as chemical reaction and diffusion patterns. Some of the basic concepts, specifically limited to carbon monoxide as a pollutant, in terms of data analysis and evaluation are as follows: the correlation between the concentration of pollutant and the emission source (moving automobiles), the correlation between concentrations and meteorological conditions, the analysis of the concentration frequency distribution, the correlation between the measurement time period and data, and the way in which short-period (one hours or less) data are handled.

3281 APTIC NUMBER 21597

Morris, E. D., Jr. and Harold S. Johnston
ULTRAVIOLET SPECTRUM OF THE ClOO RADICAL. J. Am. Chem. Soc., 90(7):1918-1920, March 27, 1968. 7 refs.

Chlorine at 1.8 torr in the presence of 1 atm of oxygen was photolyzed by fluorescent lamps flashing in a square-wave mode at 1 cps. A modulation spectrum was observed between 2250 and 2900 A. A small negative phase around 2300 and 2400 A represents a fast intermediate, while the larger negative angle around 2800 A indicates a slow intermediate which was identified as ClO. A spectrum of the fast intermediate with minimum interference from ClO was obtained directly at 40 cps and another was obtained by decomposing the 0.25-cps spectrum. Both methods were in good agreement. The fast intermediate was identified as the radical ClOO.

3282 APTIC NUMBER 21586

A NORWEGIAN-BUILT AND -OWNED L.P.G./AMMONIA CARRIER. Motor Ship, 66(547):531-534, Feb. 1966.

Design statistics and cargo and water ballast tank capacities are presented for the first fully refrigerated Norwegian liquefied petroleum gas and ammonia carrier. The ship, which will carry LPG gas cargoes at atmospheric pressure, has three holds, all forward of the propulsion machinery and accommodation spaces. The first hold has a single tank and the others a larger double tank. Cargoes to be carried will include propane, which has an atmospheric pressure boiling point of -42 to -48 C; butane, with a boiling temperature of about -2 C at atmospheric pressure; and liquid ammonia at -33 C. Two different cargoes can be carried simultaneously. Loading will take place when the cargoes are in the refrigerated state. Since the cargoes become explosive in air and are dangerously cold and poisonous, safety regulations require two barriers between the cargo and the hull. The tanks themselves constitute the first barrier and the inner hull the second. Gases which evaporate in transit will be reliquefied on board by a plant comprising three refrigerant units with 22 compressors and evaporators, each rated at 77,000 kcal/h. Any buildup of potentially dangerous gas concentrations will be detected by an infrared analyzer, served from 14 points where leakage and dangerous concentrations could occur.

3283 APTIC NUMBER 20932

Mueller, Robert F.
ENERGETICS OF HCL AND HF IN VOLCANIC EMANATIONS. Preprint, National Aeronautics and Space Administration, Greenbelt, Md., Goddard Space Flight Center, 32p., June 1969. 37 refs. (Paper NASA-TM-X-63608.)
CFSTI: N69-32034

Thermochemical data were used to calculate the fugacities of HCl and HF in equilibrium with halogen salts and crystalline silicates. The calculated fugacities were compared with the abundances of HCl and HF in fumarolic gases. Good agreement between the calculated values and the results of hydrothermal experiments were obtained. In the case of fumaroles, the abundances of HCl and HF molecules can be explained by assuming some undersaturation of the systems in such crystalline components as NaCl, CaSiO3, and Al2SiO5. Also, the fumarolic gases gave evidence that high temperature abundances of HCl and HF are quenched to much lower temperatures recorded at the fumarolic vents. Numerous determinations of Cl and F in igneous and crystalline rocks showed that on the whole, F is more abundant than Cl. Igneous rocks and minerals are quite distinct from volcanic emanations in terms of the F/Cl ratios. The relations between HCl and HF and the structure of the silicate melt were also discussed. Although heterogeneous equilibria may be established at high temperatures between the the halogen gases and crystalline phases of the wall rock, the ultimate source of most of the halogens is the silicate melt. Although the structure of such melts is not well known, it is reasonable that both the decrease in liquidus temperatures and viscosity are attributable to reactions in which the Si-O-Si bridges are destroyed by the reaction with water. (Author abstract modified)

3284 APTIC NUMBER 20958

Murray, J. D.
SOME BASIC ASPECTS OF ONE-DIMENSIONAL INCOMPRESSIBLE PARTICLE-FLUID TWO-PHASE FLOWS. Astronaut. Acta, 13(4):417-430, 1967. 15 refs.

Two simple two-phase flows in which the voidage (epsilon) can vary from unity down to the vicinity of the closed packed or saturation voidage (epsilon s) are described on a continuum basis. Compressibility of the fluid, heat, effect and gravity effect are not considered. In a converging transition region which joins two uniform sections in a quasi-one-dimensional channel flow, epsilon can have a minimum which is smaller and hence closer to the saturation voidage than either of the values for epsilon in the uniform sections. Thus, general optimal particle transport conditions in nonuniform pipes must be determined with such minima in mind if choking is to be avoided. In the pneumatic transport of solids in two-phase flows past obstacles or along pipes, it is important to know the effect on flow fields on inserting flow-diverging vanes in channels. Accordingly, a method is given for estimating the flow and shear stresses for flow past a semi-infinite flat plate. The method can be applied to the evaluation of the effect of aerosol flows on tube walls of the respiratory tract. (Author abstract modified)

3285 APTIC NUMBER 20875

Murray, R. W., R. D. Youssefyeh, and G. J. Williams
OZONOLYSIS. CONCENTRATION AND SOLVENT EFFECTS. Tetrahedron, vol. 24:4347-4352, 1968. 23 refs.

The ozonolysis of cis- and trans-1,2-diisopropylethylene was first carried out in four different solvents at the same concentration to determine the effect of the solvent on the reaction. The results indicated a very definite solvent effect on both yield and stereoisomer distribution, but did not establish a direct relationship between the ozonide stereoisomer and solvent polarity. While the polar solvents ethyl acetate and diethyl ether substantially increased the percentage of trans ozonide produced for the cis and trans olefin, methylene chloride, a solvent of higher polarity than diethyl ether, produced only a slight increase in the percentage trans ozonide for both olefins. Methylene chloride also gave a low yield of cis olefins. Only diethyl ether substantially increased the yield of trans isomers. Ozonide stereoisomers from trans- and cis-1,2-diisopropylethylene were next prepared from varying concentrations of pentane and analyzed for ozonide yield and cis-trans ratio. The ozonide cis-trans ratio is a function of olefin stereochemistry and the distribution is constant over a large concentration range. More than one mechanism of ozonide formation is demonstrated. Of the two possible pathways contributing to the cis-trans ratios, one is dominant at low concentrations but is overwhelmed by another pathway that is dominant over the large concentration range. This dominant pathway, which is probably bimolecular, could involve the reaction of two olefin-ozone adducts or of one such adduct with an aldehyde molecule.

3286 APTIC NUMBER 21003

Murray, R. W., W. C. Lumma, Jr., and W. P. Lin
SINGLET OXYGEN SOURCES IN OZONE CHEMISTY. DECOMPOSITION OF OXYGEN-RICH INTERMEDIATES. J. Am. Chem. Soc., 92(10):3205-3207, May 20, 1967. 22 refs.

Ozonization of even relatively unreactive substrates, including hydrocarbons, ethers, and alcohols, can lead to the production of singlet oxygen. Hydrotrioxides are postulated as oxygen-rich intermediates. Isopropyl ether was ozonized at -70 to -80 deg, and the solution purged with a nitrogen stream was treated with singlet oxygen acceptors such as tetraphenylcyclopentadienone (tetracyclone). Each acceptor was completely bleached by samples of isopropyl ether which had absorbed ca 2.7 mmol of ozone and then warmed to -10 to + 5 deg. Cis-dibenzoylstilbene, the product of the reaction, was isolated by column chromatography on neutral alumina. The oxygen-rich intermediates did not bleach tetracyclone below the temperatures at which they decompose. With tetramethylethylene or diisopropylethylene, the intermediate does not give the normal ozonolysis reaction which would be expected for an ether-ozone complex, and the structure is assumed to include a hydrotrioxide. The experimental results are of particular importance to air pollution studies since atmospheric singlet oxygen may be involved in the conversion of NO to NO2.

3287 APTIC NUMBER 21219

Neuberger, M. and D. B. Carter
MAGNESIUM OXIDE. Hughes Aircraft Co., Culver City, Calif., Electronics Properties Information Center, Air Force Materials Lab. Contract F33615-68-C-1225, Proj. 7381 and 8975, Task 738103 and 897501, Rept. DS-163, 99p., Oct. 1969. 153 refs.
CPSTI, DDC: AD 698383

The refractory and insulating properties and uses of magnesium oxide have been thoroughly studied in the form of polycrystalline and pressed grain or powder forms as well as for ceramic binary and ternary compounds of MgO with other metallic oxides. With the development of solid state technology, the unique properties of single crystals united with the refractory and insulating character of MgO, as well as its useful optical properties, make this compound a very promising material, e.g. as a host lattice in laser research. Physical and electronic properties for MgO are presented in tabular form, with emphasis on dielectric properties and the energy band structure. Much work deals with optical absorption investigations of MgO to determine its energy band structure as well as the energy levels and color centers caused by impurities and U.V-, X-, gamma- and particle irradiation. The band gap of MgO has finally been placed at 7.77 eV. (Author introduction modified)

3288 APTIC NUMBER 21507

Nix, Norbert

CONDENSATION AND EVAPORATION AT SINGLE PARTICLES OF SMALL AEROSOLS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(5):15-19, May 1969. 7 refs.

A new type of expansion-condensation chamber is described which permits photographic recording of condensation and evaporation of water from platinum nuclei constrained to oscillate at frequencies up to 60 cps along elliptical paths in the viewing plane. Each point on the ellipse corresponds to a definite thermodynamic state with which the variable quantities such as temperature and pressure as well as relative humidity are associated. For these values the instantaneous size of the water droplet can be determined via the magnification of a microscope. Traces made when city air was mixed with cigarette smoke and platinum nuclei showed strongly deformed elliptical tracks, suggesting the presence of factors which hinder condensation and evaporation (possibly organic layers enclosing the droplets). The visibility limit of droplet size is 0.2 micron with this system and effort is being made to extend to method to higher cyclic frequencies.

3289 APTIC NUMBER 21260

STORAGE PLANT DEVELOPMENTS. 1. -LNG PLANT IN THE U. S. A. Oil Petrochem. Equipment News, 12(1):40-42, Aug. 1966.

The first commercial liquefied natural gas plant built in the United States came into operation in 1965 at Oak Creek, Wisconsin, cost $2 million, and is a 'peak shaving' plant designed to liquefy and store a 1-million gallon reserve of natural gas. A double walled flat bottom storage tank is the most important component of the facility. The inner tank has a net liquid capacity of 72,000 bbl (250 million cu ft of gas). It is 71 ft 6 in. in diameter, 101 ft high, and built of aluminum alloy 5083. The outer tank is made of carbon steel and supported by a reinforced concrete ring wall foundation. Boil-off rate is approximately 0.07% of the tank's capacity. The liquefaction process is a cascade system employing propane and ethylene as the refrigerants, producing a net daily fill rate of 0.75 million cu ft. To operate free of CO2 solids, carbon dioxide is removed from the incoming gas stream by molecular sieve beds.

3290 APTIC NUMBER 20506

Owe Berg, T. G., Margaret J. Hunkins, and M. Julie Stansbury
INVESTIGATION OF THE FORCE OF ADHESION BETWEEN POWDER PARTICLES. Aerojet-General Corp., Downey, Calif., Ordnance Div., Contract DA-18-108-405-CML-829, Proj. 4C04-15-029, Rept. 0395-04(04)SP, 32p., March 31, 1963. 33 refs.
CFSTI, DDC: AD 671010

As part of an investigation of agglomeration in powders and aerosols, a determination was made of the force of adhesion between solid particles in contact with one another, with emphasis on the effect of humidity. The literature on these and related subjects is briefly reviewed, and the technique developed by Cremer for measuring adhesion in powders is extended to yield the force of adhesion between powder particles and the proportionality of this force to the surface area of the individual particles. This procedure permits separate determinations of the force of adhesion and the coefficient of friction at least for the glass slide and silica sand (40-200 micron) used in these experiments. Measurements of the silica sand at various relative humidities ranging from 0.5-7% showed that the force constant is proportional to the relative humidity in the 3-7% range, indicating adhesion by hydrogen bonding between surface water and OH groups in the silica. In the 0-3% range, the force constant is much larger than would be derived from this law, and closely resembles the corresponding curve for the charge on glass as a result of friction. The force constant is zero at zero humidity and shows a maximum at 2.2% relative humidity. The adhesion in this region is caused by electrostatic forces. (Author abstract modified)

3291 APTIC NUMBER 20408

Pasteur, Felix
SOME PROPERTIES OF FENCHONE. (Sur quelques proprietes de la fenchone). Text in French. Bull. Sci. Pharmacol., vol. 38:279-281, 1931. 1 ref.

The solubility was determined, in weight%, of sulfur dioxide, methyl chloride, ahyl chloride, iodine, ammonia, and carbon dioxide in fenchone (C10H16O) at ambient pressure at temperatures between 0 and 150 C by bubbling the gas through it until saturation. At each temperature, the density of the solution, its volume, the increase in its weight, and the amount of the solute were measured. The amount of SO2 was determined by titration with I. None of the solutes were altered chemically by the solvent. The solubility curves of SO2, CH3Cl, and C2H5Cl are shown in a graph; that of SO2 decreases from 40 weight% at 0 C to about 0.5 weight% at 150 C. The solubility of I is 30 weight% at 25 C; those of NH3 and CO2 are about 0.5 weight% each. At low temperatures, the liquid solutions are immiscible in all proportions. A saturated SO2 solution stored in unstoppered flasks remained unchanged during a year-long exposure to ambient air. Heated to about 120 C, it released most of the SO2 without noticeable entrainment loss of the solvent. The solubility of SO2 in fenchone decreases by additions of wool or rubber, both of which absorb SO2, of camphor, or of liquid mixtures of camphor with alcohols, aldehydes, phenol, and the like. A saturated I solution likewise remained unchanged during a year-long exposure. However, I cannot be separated from the solvent, either by sublimation or by distillation, due to the closeness of the boiling point of I (184 C) to that of fenchone (195 C). The I solution in fenchone can probably be used as a substitute for the I tincture. Solubility determinations in fenchol, the alcohol corresponding to fenchone, yielded substantially the same results as above, except that the solubility of C2H5Cl in fenchol is even higher than in fenchone. The chemical structure of fenchone is similar to that of camphor and it appears that it can replace the latter in certain pharmaceutical, chemical, and industrial applications.

3292 APTIC NUMBER 21391

Person, James C. and Paul P. Nicole
ISOTOPE EFFECTS IN THE PHOTOIONIZATION YIELDS AND THE ABSORPTION CROSS SECTIONS FOR ETHYLENE AND N-BUTANE. J. Chem. Phys., 49(12):5421-5426, Dec. 15, 1968. 35 refs.

The absorption cross section, sigma, and the photoionization yield, eta (the probability that photon absorption produces ionization), are reported for ethylene, C2H4 and C2D4 at 44 photon energies between 10.44 and 11.78 eV, and for n-butane and n-butane-d10 at 37 photon energies between 10.56 and 11.78 eV. For ethylene, the nature of the isotope effects on sigma, eta, and the photoionization cross sections, indicates that the increase in eta upon deuteration is not the result of a simple competition between preionization processes and atomic-rearrangement processes in the superexcited states. The isotope effects for n-butane and the implications of the results for radiation chemistry are also discussed. Experimental apparatus included a hydrogen-discharge light source, a vacuum monochromator, a dual-beam detector system, and a stainless steel ionization chamber with lithium fluoride windows. A highly transparent tungsten mesh covered the LiF windows to maintain a suitable electrical-potential distribution in the ionization region. (Author abstract modified)

3293 APTIC NUMBER 21510

Peterson, J. R., S. J. Morizumi, and H. J. Carpenter
THERMAL RADIATION FROM STORED LNG RELEASE. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 9p. 8 refs. (April 7-12, Paper 5-25.)

A theoretical model was developed for a large pool fire of liquefied natural gas, one part of which describes the thermodynamic and flow properties in the flame as a function of position, the other part a radiation model. A supplementary model calculates inherently three-dimensional radiation to external regions. Important consideration for large fires (measured in hundreds of feet) include: absorption of radiation within the flame, radiation control of the LNG boiloff rate, atmospheric circulation, and the effect of extended residence time on chemical kinetics. In order to make the problem tractable, the flow is treated as one-dimensional (with two-dimensional corrections for cross winds). In the lateral direction, the flow is prescribed by assumed Gaussian contours. The computational procedures for the determination of radiant heat flux involve the integration of radiant intensity along selected lines of sight and the integration over the required solid angle. Calculation of heat flux is performed for a number of spectral values throughout the range of interest to obtain the spectral distribution of heat fluxes. For carbon soot, the total cross section based on MIE theory is used to calculate the transmissivity of the particle cloud; for the determination of spectral radiant intensity along a given line of sight, the Curtis-Godson, two-parameters method is used.

3294 APTIC NUMBER 21585

METALS FOR LOW-TEMPERATURE STORAGE VESSELS. Petrol. Times, 69(1766):202-203, April 16, 1965.

Metals for low-temperature storage vessels are considered in terms of three boiling ranges of gases: from zero to -50 C, -50 C to -150 C, and below -150 C. The third category is the most important by far since it covers liquid oxygen, ethane, and nitrogen, all of which are now handled in huge quantities. For these gases and others, 9% nickel steel is shown to be stronger than competitive materials, i.e., aluminum-magnesium alloys, and cheaper on a cost/lb basis. The economic advantage of 9% nickel steel is illustrated by cost comparison to aluminum alloy and stainless steel for flat-bottomed, cylindrical LNG storage tanks. The main drawback of 9% nickel steel at present is that a weld metal with composition and properties matching the parent steel has not yet been developed. Other new cryogenic materials are a cast iron, SG Ni-Resist Type D-2M, intended for compressors, pumps, and valves, and a 36% nickel-iron alloy for use in vacuum-insulated LNG pipelines.

3295 APTIC NUMBER 21464

Petrushevskiy, M. S. and P. B. Gel'd
CALCULATING THE SOLUBILITY OF CARBON IN FERROSILICON MANGANESE AND FERROSILICON CHROMIUM IN QUASICHEMICAL APPROXIMATION. (Raschot rastvorimosti ugleroda v ferrosilikomargantse i ferrosilikokhrome v kvazikhimicheskom priblizhenii). Text in Russian. Zh. Prikl. Khim., 40(11):2399-2405, 1967. 16 refs.

The possibility of employing quasichemical approximation, taking into account the ordering of atoms, to calculate the solubility of carbon in three- and four-component alloys (iron-manganese-silicon-carbon and iron-chromium-silicon-carbon) is demonstrated. The good agreement observed between quasichemical approximation and available experimental data further substantiates the micro-nonuniform structure model for alloys containing strongly interacting particles.

3296 APTIC NUMBER 21607

Petsinger, R. E. and C. C. Hanke, Jr.
THE IMPORTANCE OF NOTCH TOUGHNESS. Cryogenic Eng. News, vol. 1:34-35, Nov. 1966. 1 ref.

Laboratory tests indicate that superior notch toughness can be obtained in 9% nickel steels without stress relieving after fabrication and by a quenching and tempering treatment rather than be the conventional double-normalizing and tempering treatment. Significant economies could be realized through elimination of stress relieving, especially in large field-erected vessels for which stress relieving costs are usually prohibitive, while besides producing a superior material, quenching permits a further economy by eliminating one heat treating operation. To attain the most effective results, tests were conducted in full-scale vessels with representative practical design and fabrication details; the first was a type intended to stimulate the details that might be used in shipboard containers for liquefied gas, and the second was a type used for stationary storage of commercial liquefied gases, such as oxygen, nitrogen or argon.

3297 APTIC NUMBER 21512

Pierot, M.
OPERATING EXPERIENCES OF THE ARZEW PLANT. Text in French. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 9p. (April 7-12, Paper 2-106.)

Essential characteristics of the Arzew liquefied natural gas plant and data indicating the success of the installation are presented. Problems of continuous operation are discussed, as well as the theoretical aspects of power requirements. Plant load factor both before and after the liquefaction train is included. Mechanical problems, particularly regarding the turbocompressor are described. Other problems include gas purity, purification, and clogging due to heavy components. Operational simplifications are mentioned, while the trend is toward a flexible preventive maintenance policy and the minimization of annual interruptions. Problems of professional training necessary for the operation of such plants are also raised.

3298 APTIC NUMBER 20584

Poferl, David J., Roger A. Svehla, and Kenneth Lewandowski
THERMODYNAMIC AND TRANSPORT PROPERTIES OF AIR AND THE COMBUSTION PRODUCTS OF NATURAL GAS AND OF ASTM-A-1 FUEL WITH AIR. National Aeronautics and Space Administration, Cleveland, Ohio, Lewis Research Center, NASA TN D-5452, 52p., Oct. 1969. 9 refs.

The ratio of specific heats, molecular weight, viscosity, specific heat at constant pressure, thermal conductivity, and Prandtl number were calculated for air, the combustion products of natural gas and air, and the combustion products of ASTM-A-1 jet fuel and air. The properties were analytically determined over a temperature range from 300 to 2500 K and for pressures of 3 and 10 atmospheres (304,000 and 1,013,000 N/sq m). The data for natural gas and ASTM-A-1 were calculated for fuel-air ratios from zero to stoichiometric. Adiabatic combustion temperatures over the same range of pressure and fuel-air ratios were also determined for natural gas and ASTM-A-1. Theoretical values of Prandtl number and thermal conductivity for air and the combustion products of a $(CH_2)_n$ type hydrocarbon jet fuel at the stoichiometric fuel-air ratio were compared with data from an independent experimental investigation. The maximum difference between experimental and theoretical Prandtl numbers and thermal conductivities was less than 5 percent. The values obtained are required for the development of basic heat-transfer correlations intended to improve the reliability of predicting turbine blade and vane local temperatures. (Author summary modified)

3299 APTIC NUMBER 20921

Polak, L. S. and V. S. Shchinachev
OPTIMIZATION OF THE PROCESS OF OBTAINING NITRIC OXIDE IN A PLASMA JET. (Voprosy optimizatsii protsessa polucheniya okislov azota v plazmennoy struye). Text in Russian. In: Kinetika i Termodinam. Khim. Reaktsii v Nizkotemperaturnoi Plazme. Sinteza, Akad. Nauk. SSSR, Inst. Neft, 1965, p. 151-166. 6 refs.

The possibilities of obtaining technically useful concentrations of nitric oxide by mixing a plasma jet of nitrogen with excess oxygen are examined. The economic need for reducing the expenditure of energy in this process leads to an examination of the following schemes: 1) formation of an equilibrium concentration of nitric oxide, formed at high temperatures, i.e., assuring a cooling regime so that decomposition is minimized; 2) formation and simultaneous freezing of nitric oxide upon interaction of a nitrogen plasma jet with water; 3) formation and simultaneous freezing of nitric oxide upon interaction of a nitrogen plasma jet with oxygen; 4) and formation of nitric oxide with an equilibrium concentration in air with subsequent freezing through mixing of the hot nitrogen oxides with the already cooled gases. Other topics discussed are: reaction processes; methods of freezing nitric oxide; and the effect of flow temperature-field nonuniformity on average-mass parameters. Experiments in obtaining nitrogen oxides in a plasma jet at high pressure are also briefly discussed.

3300 APTIC NUMBER 20559

Polydorova, Marie
GENERATION AND PROPERTIES OF A CHROMIUM OXIDE AEROSOL. Staub (English translation from German of: Staub, Reinhaltung, Luft), 29(6):38-39, June 1969. 5 refs.

A chromium oxide aerosol, formed by electrically heating a nichrome wire, shows only a small dispersion in particle size distribution. For a surface temperature of the wire in the range of 1100 C to 1150 C, and for an airflow rate of 2 to 8 l/min, it is possible to obtain reproducible aerosols of a mean geometrical particle diameter of 0.014 to 0.028 micron and with a logarithmic standard deviation below 0.32. (Author summary modified)

3301 APTIC NUMBER 20424

Rempt, Raymond Doak
ELECTRON IMPACT STUDIES OF ELECTRON CAPTURE AND EXCITATION NEAR THRESHOLD IN VARIOUS GASES. California Univ., Los Angeles, Dept. of Physics, Contract F19628-69-C-0296, Proj. 8666, Task 866601, Work Unit 86660101, AFCRL-69-0367, 92p., Sept. 30, 1969. 109 refs.
CSFTI, DDC: AD 697409

A total collection ionization device of the Tate and Smith type was employed to study resonance dissociateive attachment by electron impact on target gas molecules and to trap electrons having suffered an inelastic collision with a gas molecule. All measurements use DC technique which makes the data quiet and not susceptible to the spurious breaks sometimes caused by the application of the AC RPD method. Since it is possible to tune the ionization device to collect very slow electrons, and since the electron beam has a fairly narrow energy distribution of less than 0.2 eV at half-height, high resolution near threshold excitation spectra are obtained in carbon monoxide, nitrogen,

hydrogen, and methane. Pronounced vibrational structure is revealed in CO, H2, and N2. In CO, vibration structure is revealed in transient negative ion formation which enables the establishment of an upper limit to the electron affinity of CO at -1.8 + 0.1 eV. High resolution data in the excitation spectra facilitate an accurate energy calibration, and new structure is revealed in CO, N2, and CH4, as well as much quieter data than has been reported before in H2. Resonance dissociative attachment is studied in carbon monoxide, nitrous oxide, oxygen, and methane, and new structure is revealed in nitrous oxide and possibly hydrogen. (Author abstract)

3302 APTIC NUMBER 20569

Roques, C. and J. Dollet
NINE PERCENT NICKEL STEEL: METALLURGICAL PROPERTIES AND EFFECTS ON WELDABILITY. Welding Metal Fabric., vol. 31:260-264, June 1963. 10 refs.

The first of a series of tests on nine percent nickel steel was conducted to determine satisfactory values for the elastic limit, tensile strength, and impact resistance of the material at 196 C during welding operations with chromium-nickel and chromium-nickel-molybdenum electrodes. In latter tests, physical properties of the material, its tensile strength over a large temperature range, and the stability of its mechanical properties after prolonged soaking at low temperatures were determined. The results are presented in tables and illustrated graphically. Very satisfactory values were obtained for the properties of weld joints, particularly with electrodes having a high manganese content. The physical properties (Young's modulus, coefficient of expansion, thermal conductivity, and specific heat) were established as exceptionally satisfactory. With respect to tensile strength, the notch sensitivity of nine percent nickel steel was comparable with that of carbon and low alloy steels and better than that of martensitic 13% chromium steels. The impact properties of the material and its weld areas were not adversely affected after three months soaking in liquid methane.

3303 APTIC NUMBER 21461

Rosenqvist, Terkel
A THERMODYNAMIC INVESTIGATION OF THE SYSTEM SILVER-SILVER SULPHIDE. Metals Trans., vol. 185:451-460, Aug. 1949. 17 refs. (Presented at the Am. Inst. Mining Met. Engrs., Columbus, Ohio, Sept. 1949.)

An investigation is reported based on the reaction of sulfur from the silver sulfur alloys with hydrogen to form hydrogen sulfide, the equilibrium ratio H2S/H2 being a measure of the escaping tendency of sulfur. An apparatus was designed in which the equilibrium gas ratio was obtained by circulating the gas mixture over the specimen, and the composition of the gas mixture was subsequently determined from its density by means of a buoyancy-balance. The possible sources of error are discussed. Altogether 22 samples containing up to 33.3 at.% sulfur have been studied over the temperature range 500-1300 C. The equilibrium ratios H2S/H2 are plotted as a function of temperature and alloy composition. It is shown that the immiscibility region in the system has a critical temperature of about 1125 C corresponding to a critical composition of 24 at.% sulfur. Various thermodynamic calculations are carried out on the heat and standard free energy of several reactions, the heat of fusion of Ag2S, and on the partial heat content and chemical activity of liquid sulfur and silver. The relation between thermodynamics and the structure of the silver-silver sulfide melts is discussed, and a model is suggested that is consistent with observed thermodynamic data and also with the immiscibility in the system. (Author summary modified)

3304 APTIC NUMBER 21406

Rossetti, Salvatore J. and Robert Pfeffer
EXPERIMENTAL DETERMINATION OF PRESSURE DROP AND FLOW CHARACTERISTICS OF DILUTE GAS-SOLID SUSPENSIONS. City Coll., New York, NASA Grant NGR 33-013-029, CR-72628, 233p., Oct. 1, 1969. 69 refs.
CFSTI: N70-12705

A closed loop experimental setup was assembled for the purpose of making pressure drop and turbulence measurements for dilute gas-solid suspensions flowing in a tube. The apparatus included a two-phase flow meter for solids concentration determination and solid state anemometry for velocity and turbulence measurements. Five different sizes of glass beads ranging from a nominal diameter of 10 to 60 micron were circulated at loading ratios up to 2.5. Three different air Reynolds number ranges from 12,000 to 25,000 were investigated in both a vertical and horizontal test section. For the vertical test section, lower pressure drops were obtained for all of the dilute gas-solid suspensions studied than were observed for the pure gas at the same gas Reynolds number. For the horizontal test section, pressure drop increases above the pure gas values were found for the two largest sized particles but decreases were also observed with the smaller particles. An explanation for this phenomenon of drag reduction based on the interaction of the particles with the turbulent structure of the fluid in the vicinity of the wall has been suggested. In addition, a literature survey is presented in which some of the more significant and recently published work on flow characteristics of gas-solid suspensions is summarized in terms of small and large particle experimental studies, analytical studies, and drag reduction with liquids. (Author summary modified)

3305 APTIC NUMBER 21511

Salama, C.
DEVELOPMENT OF AN LNG FACILITY FROM PILOT PLANT TO FULL-SCALE INSTALLATION. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 13p. 3 refs. (April 7-12, Paper 4-20.)

A description of a pilot plant utilizing the autorefrigerated cascade cycle is given in support of the argument for the use of pilot plants as an intermediate step between a new process scheme and a full scale installation. The plant was built by Air Liquide and Gaz de France in Nantes, France, and has a capacity of 1 MMSCFD of liquefied natural gas. Performance tests are

discussed which provided the designator for two peakshaving facilities incorporating the APC cycle. The limited usefulness of the pilot plant for subsequent experimentation and modification toward improving overall operation is also pointed out.

3306 APTIC NUMBER 21142

Schicketanz, Walter
THEORY OF THE METHOD OF MEASURING CAPILLARY RISE FOR DETERMINING THE WETTABILITY OF DUSTS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(10):23-26, Oct. 1969. 4 refs.

The relationship between the wettability of a dust and its suction velocity was investigated experimentally and theoretically. The starting point for the theoretical analysis is the differential equation for the motion of a liquid in a capillary tube. A solution for horizontal motion is given. The initial velocity has a finite value from which a characteristic factor for wetting behavior can be derived. Preliminary experiments are in qualitative agreement with theory. (Author summary)

3307 APTIC NUMBER 21628

Scholz, F. O. and A. Berner
THE PREPARATION OF PARTICLES OF MAGNITUDE IN SIZE OF 10(-5) BY PHOTO CHEMICAL PROCESSES. Preprint, Vienna Univ., Austria, Physikalisches Inst., 14p., 1969. Translated from German. Telov and Associates, Denver, Colo., 4p., April 3, 1970.

Experiments are reported on the decompositions of hydrogen sulfite with ultraviolet radiation, to investigate photochemical methods of aerosol formation. Such methods have the advantage of permitting a constant reaction and nucleus formation in the entire reaction vessel, and sensitive control of the reaction through radiation dosage. The diluted and purified gas is passed into a ring-shaped radiation pipe. After radiation, the reaction mixture is thinned and transferred into an aerosol centrifuge for measuring the size distribution of the aerosol. This distribution depends upon the duration of radiation and the concentration of the gas. Magnification of the product from duration time and concentration results in a shift of the distribution function toward larger particles. A changing, intermittent radiation of the reaction mixture results in a monodispersed size distribution.

3308 APTIC NUMBER 21037

Secchi, G. C. and L. Alessio
STUDIES ON THE MECHANISM OF THE INHIBITION BY LEAD OF ERYTHROCYTE Na(+)/K(+) -ATPASE. (Ricerche sul meccanismo d'inibizione della Na(+)/K(+) -ATPasi eritrocitaria ad opera del piombo). Text in Italian. Med. Lavoro (Milan), 60(11):670-673, 1969. 6 refs. (Presented at the International Congress of Clinical Chemistry, 7th, Geneva, Sept. 8-13, 1969.)

A study of the mechanism of the inhibition by lead of sodium(+)/potassium(+) -adenosine triphosphatase demonstrated that lead can partially inhibit this enzyme of the red blood cell membranes both in vivo and in vitro at 1 mM concentration. The inhibition of such enzyme activity could be completely removed by adding cysteine at 25 mM concentration. (Author abstract modified)

3309 APTIC NUMBER 21038

Seifert, H. J. and F. M. Thurn
ELECTROLYTIC REDUCTION OF TiCl4 IN METHANOL. (Elektrolytische Reduktion von TiCl4 in Methanol). Text in German. Z. Anorg. Allgem. Chem., 372(1):79-86, Jan. 1970. 25 refs.

The crystalline adducts titanium trichloride-4 methanol and titanium trichloride-5 methanol by the electrolytic reduction of solutions of titanium tetrachloride in methanol blue solutions of TiCl3. These solids were used as starting materials for the preparation of other TiCl3 complexes. By an exchange of ligands, blue TiCl3-3 dimethyl formamide was obtained which, in vacuo, could be thermally decomposed to green TiCl3-2 DMF. The thermal decomposition of TiCl3-3 tetrahydrofuran was studied. Measurements of the magnetic susceptibilities, infrared and electron spectra of TiCl3-3 THF are reported. (Author abstract modified)

3310 APTIC NUMBER 20876

Setser, D. W. and D. H. Stedman
CHEMICAL APPLICATIONS OF METASTABLE EXCITED ARGON ATOMS. I. THE HEAT OF FORMATION OF THE CN RADICAL. J. Chem. Phys., 49(1):467-469, July 1, 1968. 11 refs.

The heat of formation of CN-containing compounds depends on the controversial heat of formation of the CN radical. The JANAF tables conclude that the heat of formation at 298 deg is 111 kcal reciprocal mole. By means of an indirect technique, the present study suggests an upper limit of 103 reciprocal mole. The emission spectra produced by the reaction of CN compounds with metastable excited argon atoms generated in a flow system was first investigated. Two thermodynamic values of bond energy for HCN, C2N2, CH3CN, and H3NCN were calculated using 110 or 111 kcal reciprocal mole as the heat of formation of CN. Conversely, upper limits for the heat of formation of the CN radical in these molecules, plus CF3CN, were obtained from the experimental data and the known thermochemistry. Since the effect of the heat of formation of CN on the bond energy is doubled in the case of C2N2, the most precise upper bound value of the heat of formation of CN is less than 103 kcal reciprocal mole. The fact that CN vibrational bands appear to contain some rotational energy is further support for the lower value for the heat of formation.

3311 APTIC NUMBER 21159

Shearer, J. W., T. A. Wiggins, A. H. Guenther, and D. H. Rank
L-TYPE DOUBLING IN N2O. J. Chem. Phys., 25(4):728-729, Oct. 1956. 12 refs.

Doublet separation in nine pi-pi bands of the linear nonsymmetrical molecule N2O was measured in the region 1.5-2.4

microns. In addition to the doublet splitting caused by the upsilon 2 mode, it is shown that the parrallel modes upsilon 1 and upsilon 3 contribute measurable amounts to this splitting in pi states. The doubling constant is thus a function of all three vibrational quantum numbers. The data satisfactorily fit an equation describing the Coriolis coupling of upsilon 2 with upsilon 1 and upsilon 3. The equation assumes that the effect of coupling is seen only by a change in the motion of the upsilon 2 mode, which has a degeneracy of 2, and that the oscillations caused by upsilon 1 and upsilon 3 are doubly degenerative. With one exception the observed doubling constants were consistent with calculated Coriolis constants.

3312 APTIC NUMBER 20544

Sieck, L. Wayne and J. H. Futrell
RATE CONSTANTS FOR CHARGE EXCHANGE INVOLVING QUASITHERMAL IONS AND NITRIC OXIDE. J. Chem. Phys., 48(3):1409-1410, Feb. 1968. 4 refs.
CPSTI, DDC: AD 674804

Rate constants for charge exchange involving quasithermal ions and nitric oxide were measured with a mass spectrometer. The relative rates of exchange were independent of the current density in the primary beam and of the pressure of NO in the 1-10 micron range. Absolute rate constants were estimated by comparing the NO(+)signal obtained with the CH4(+) +NO reaction pair with the intensity of CH5 (+) observed when 5 micron of CH4 were substituted for 5 micron of NO. Plotting the rate constants against the apparent recombination energy (ionization potential of M), the values fit, to a first approximation, a monotonically increasing function reminiscent of a low-energy ionization efficiency curve for NO. The behavior is particularly evident within the series, beginning with trans-2-butene. The results obtained for C3 (+) ions indicate either that internal energy is effective in increasing the probability for charge exchange or that species such as C3H6(+) and C3H4(+) have relatively long-lived structural isomers exhibiting different recombination energies.

3313 APTIC NUMBER 21513

Sinclair, David
EFFECT OF CONVECTION AND TURBULENCE ON DIFFUSION OF SMALL AEROSOL PARTICLES IN CIRCULAR TUBES. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(5):13-15, May 1969. 4 refs.

Diffusion of aerosol particles ('condensation nuclei') with diameters predominantly less than 0.1 micron was studied flowing through straight and coiled tubing. The deposition, and hence the apparent particle size, was greatly affected by convection and turbulence induced by flow around bends in coiled tubing, by too high a flow rate, and by the pulsating flow from the General Electric condensation nuclei counter used for measurement. It is concluded that diffusion should be measured in perfectly straight tubes, the Reynolds number should not be greater than 350, and the G.E. counter should not be used.

3314 APTIC NUMBER 21445

Sioda, R. E.
ELECTROLYSIS WITH FLOWING SOLUTION. Electrochim. Acta, 13(3):375-382, March 1968. 33 refs.

A new type of electrolytic cell with a flowing solution is described. The working electrode is composed of a piece of 80-mesh platinum grid rolled together to form a plug. The electrolysed solution flows under gravitational force through the pores of the electrode. The reduction of K3Fe(CN)6 and of O2, and the oxidation of 9, 10-diphenylanthracene, were employed to test the operation of the cell. The limiting currents of the reduction and of the oxidation are practically linear with respect to the flow velocity. The cell can be used for preparative electrolyses, especially in the case of unstable electrolytic products which decompose easily or react to form electro-active secondary species. Application of continuous electrolysis may result in considerable saving of time in comparison with ordinary 'batch' processes. When the efficiency of the cell is determined, the cell can be used for coulometric measurements and analytical purposes. (Author abstract modified)

3315 APTIC NUMBER 20936

Slinn, W. G. N.
BROWNIAN DIFFUSION IN A NONUNIFORM GAS. In: Pacific Northwest Laboratory Annual Report for 1968 to the USAEC Division of Biology and Medicine. Vol. II: Physical Sciences Part I. Atmospheric Sciences. Battelle-Northwest, Richland, Wash., Pacific Northwest Lab., p. 59-61, Nov. 1969. 8 refs.
CPSTI: BNWL-1051

The motion of a small Brownian particle in air that is in thermal and translational nonequilibrium was analyzed. A new force is described which is similar to that used to explain the thermophoresis effect but which depends on the viscous stress in the gas. The solution to the new Fokker-Planck equation in velocity space has been found. In the generalized convective-diffusion equation, the diffusion coefficient appears as a second order tensor and exhibits the influence of the viscous stress tensor on diffusion. The results are limited to the case when the particle's Knudsen number is large compared to unit. (Author abstract modified)

3316 APTIC NUMBER 20380

Smith, J. G., J. L. Kassner, Jr., and A. H. Biermann
EVAPORATION OF SMALL DROPLETS IN A WILSON CLOUD CHAMBER. PROPERTIES OF RESIDUAL NUCLEI. J. Rech. Atmospheriques, 3(1-2):

41-44, 1968. 5 refs. (Presented at the Meeting International de Comparaison des Generateurs et Compteurs de Noyaux de Condensation et de Noyaux Glacogenes, Centre de Recherches Atmospheriques, Campistrous par Lannemezan, France, Sept. 8-23, 1967.)

The behavior of droplet evaporation in the submicroscopic range was observed by producing droplets (either by homogeneous nucleation or nucleation on ions) in an expansion-compression type cloud chamber, allowing the particles to grow to 10 micron, and then compressing the particles to reduce relative humidity to about 18%. A second expansion provided the critical supersaturation for recondensation of any residue which might have been left behind. The original droplets did not evaporate completely but left a residue which was similar to an Aitken nuclei residue. One residue formed for each droplet evaporated in mid-air, and each residue was characterized by a critical supersaturation for renucleation which depended on the relative humidity and the time allowed for evaporation. Renucleation on droplet residues was analyzed in terms of Fletcher's heterogeneous nucleation theory. The results agreed well with the postulate that the evaporation coefficient varies directly according to the surface area of a drop after a certain size is reached. It is concluded that clean liquid surfaces formed during droplet growth effectively scavenge gaseous surface-active materials.

3317 APTIC NUMBER 20413

Smith, Walter J. Jr. and Wen-Yean Chen
PREPARATION OF PHENYL-N-SULFINYLHYDRAZINES USING DIMETHYLFORMAMIDE-SULFUR DIOXIDE REAGENT. Trans. Kentucky Acad. Sci., 27(1-2):37-38, 1966. 4 refs.

A solution of sulfur dioxide in dimethylformamide provides a convenient reagent for the preparation of phenyl-N-sulfinylhydrazines. The method is simple and direct. Phenylhydrazine (2.2g, 0.02 mole) and 60 ml of a saturated solution of SO2 in dimethylformamide were placed in a flask fitted with stirrer, condenser, and CaCl2 tube. The solution was heated at 75 to 80 C for 5 hours, cooled, diluted with 30 ml of benzene and sufficient water to give two layers. The benzene was separated and the aqueous layer was extracted with two additional 30 ml portions of benzene. The combined benzene extracts were washed with water and evaporated to dryness to give 1.7g (55% yield) of product with a melting point of 104 to 106 C. The above procedure was used to prepare 4-bromophenyl-N-sulfinylhydrazine (34% yield) with a melting point at 170 to 172 C; 4-nitrophenyl-N-sulfinylhydrazine (18% yield) with a melting point at 213 to 214 C; 2-nitrophenyl-N-sulfinylhydrazine (recrystallized from 95% ethanol) (16% yield) with a melting point at 127 to 128 C; and 4-carboxyphenyl-N-sulfinylhydrazine (54% yield) with a melting point at 276 to 278 C. The empirical formula of the latter is C7H6N2O3S and that of 4-nitrophenyl-N-sulfinyl which has not been previously reported is C6H5N3O3S. When a solution of 25g of phenylhydrazine and 100 ml of a saturated solution of SO2 in dimethylformamide was refluxed for 6 h, a 38% yield of phenyl-N-sulfinylhydrazine was obtained.

3318 APTIC NUMBER 20410

Sorokin, V. A. and K. V. Puzitskiy
THE REACTION BETWEEN BUTADIENE AND SULFUR DIOXIDE. (O reaktsii mezhdu butadienom i sernistym angidridom). Text in Russian. Sintetieh. Kauchuk, 2(6):12-16, 1933. 9 refs.

The reaction of butadiene was studied with 1) an aqueous solution of sulfur dioxide or 2) liquid SO2 with a view of using it for quantitative determination of butadiene. In tests with 1), a thick-walled glass bottle of 150 cu cm capacity was filled with 60 cu cm of distilled H2O which was saturated with SO2 at 0 C. A tared ampul with a weighed amount of liquid butadiene was placed in the bottle which was then hermetically sealed, heated to the test temperature ('room temperature' or 40 C), and vigorously shaken to fracture the ampul. After a specified lapse of time (2, 4, or 5 hrs or 1,2,5, or 6 days), the bottle was cooled and opened; the remaining SO2 was driven off by heating in a water bath. In tests with 2), the 150 cu cm capacity bottle was cooled and filled with 30 cu cm of liquid SO2 and the ampul with butadiene was placed into it and fractured. After a lapse of 6 days, the contents of the bottle were poured into a tared container and the excess SO2 was driven off by heating in a water bath at 20 C. Butadiene reacting with SO2 in an aqueous or alcoholic (amylene) medium focus simultaneously a soluble monosulfone and an insoluble sulfone polymer. Pure butadiene reacting with liquid SO2 forms the monosulfone only, while industrial butadiene forms both varieties of sulfone, also in the presence of a stabilizer such as pyrogallol. The butadiene sulfone polymer is an amorphous white substance insoluble in water and in organic solvents. It is very stable in air and can be dried out at 100 to 105 C. The butadiene monosulfone is a white crystalline substance melting at 65 C with a very specific odor. Above 50 C, it begins to turn yellow and decompose, and at 130 C is decomposes completely, yielding about 10% of the butadiene originally present. The studied reaction is not well suited for determination of butadiene.

3319 APTIC NUMBER 21685

Staley, D. O. and G. M. Jurica
FLUX EMISSIVITY TABLES FOR WATER VAPOR, CARBON DIOXIDE AND OZONE. J. Appl. Meteorol., 9(3):365-372, June 1970. 9 refs.

Flux emissivities for the water bands and window, and for carbon dioxide and ozone, were evaluated from Elsasser's wavelength-dependent absorption coefficients and flux transmissivities. The flux emissivities for water vapor differ significantly from previously published emissivities based on Elsasser's incorrect flux densities. A flux emissivity correction for the overlap of H2O and CO2 is defined and evaluated for combinations of optical depths. The total H2O flux emissivity is remarkably independent of temperature, especially in the range from minus 40 deg C to 20 deg C, as a result of near cancellation of the temperature dependences in three regions of the spectrum. The flux emissivity of CO2 increases slightly with temperature at all but the very smallest optical depths. The flux emissivity of O3 undergoes a large percentage decrease with temperature. (Author abstract modified)

3320 APTIC NUMBER 20954

Stedman, D. D., J. A. Meyer, and D. W. Setser
ENERGY-TRANSFER REACTIONS OF N2 (A(3) Sigma U(+))I. QUENCHING AND

EMISSION BY C2N2, SO2, AND OTHER MOLECULES. J. Am. Chem. Soc., 90(24):6856-6858, Nov. 20, 1968. 19 refs.

An argon-nitrogen flow system was used to study the reaction of N2 (A(3)-Sigma u(+): v' equals 0(142 kcal), 1(146 kcal)) with oxygen, nitrous oxide, ethene, benzene, iodine, acetophenone, biacetyl, carbon disulfide, cyanogen, and sulfur dioxide. The reactions appeared to proceed by collisional quenching with energy transfer from N2(A). The molecules O2, N2O, C2H4, and C6H6 rapidly quenched the V-K emission without apparently giving rise to subsequent emission. The addition of iodine to N2(A) showed a weak emission which consisted only of the 'continuum' between 2500 and 3450 A. Acetophenone and biacetyl quenched the V-K bands and gave emission spectra similar to the known phosphorescence spectra of the lowest triplet states at 73.6 and 58.9 kcal. The addition of C2N2 quenched the V-K emission and gave a low-resolution spectrum. The intense bands of this system were clearly doubled with a splitting of 18 plus or minus 4 reciprocal cm. The addition of SO2 gave a vibrationally relaxed triplet emission, although a singlet emission was also observed at 2500 A. The emission spectrum of CS2 was a continuum extending from 3500 to 6000 A. It is concluded that the metastable studied is a good sensitizing agent for the study of high-energy triplet states.

3321 APTIC NUMBER 20683

Stewart, R. H. and D. N. Wright
RECOVERY OF AIRBORNE STREPTOCOCCAL L-FORMS AT VARIOUS RELATIVE HUMIDITIES. Appl. Microbiol., 19(5):865-866, May 1970. 14 refs.

A study was conducted to determine the effect of relative humidity (RH) on aerosolized L-forms of group A streptococcus, and to determine if these organisms would respond to RH in a manner similar to that reported for mycoplasma. Initial air samples indicated an immediate and varied sensitivity of the L-forms to RH. Approximately 100 times as many L-forms were recovered at 80% RH as were found at 40%. During the four hour holding period, they were most stable at 29% RH. At 80% RH, one-tenth as many L-forms/l here were recovered after four hours than at 24%. Less than 10 organisms/l were found at 60% RH after two hours; and at 40%, no viable L-forms could be detected at 30 minutes. Colonial morphology of cells surviving aerosolization was not altered. This study showed that aerosolized streptococcal L-forms respond to RH in a manner similar to that reported for mycoplasma. These similarities, and those which showed that mid-range RH values also were the most lethal for certain airborne bacteria, lend support to the hypothesis that the mechanism of death of microorganisms in aerosols is independent of unique morphological features associated with the cell wall.

3322 APTIC NUMBER 21508

Stoeber, Werner
THE PROBLEM OF AEROSOL CENTRIFUGE PROPERTIES. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(5):12-13, May 1969. 6 refs.

The formation of vortex disturbances due to Coriolis forces in a centrifuge separator channel having the shape of a logarithmic spiral as opposed to an archimedian spiral is explained. A particle size spectrum of later aggregates obtained in a flat spiral centrifuge (primary particle size: 0.0007 cm) is presented, with more than 10 different aggregates deposited simultaneously and regularly according to aerodynamic diameter.

3323 APTIC NUMBER 20963

Story, Paul R., Donald D. Denson, Clyde E. Bishop, B. C. Clark, Jr., and Jean-Claude Farine
A NEW GENERAL SYNTHESIS OF MACROCYLIC COMPOUNDS. J. Am. Chem. Soc., vol. 90:817-818, 1968. 13 refs.

A simple procedure for the synthesis of macrocyclic compounds involves only photolysis of thermolysis of an appropriate ketone peroxide. The desired macrocyclic compound is generated directly in good yield. In the present investigation, carbocyclic hydrocarbons and macrocyclic lactones were synthesized. Photolysis of cyclohexanone diperoxide in methanol or benzene, using a quartz Hanovia apparatus followed by solvent remover with a rotary evaporator, yielded cyclodecane, 11-undecanolactone, and cyclohexanone. Thermolysis of cyclocheranone diperoxide yielded the same products but in appreciably higher yields. Thermolysis of most peroxides can be carried out using a gas-chromatograph injection inlet and/or column heated to about 180 deg. Pyrolysis occurs instantaneously. Pyrolysis of trimeric cycloheranone peroxide yielded cyclopentadecane, 16-hexadecanolactone, and cycloheranone. The dimeric peroxide of cycloheptanone gave cyclotetradecane and 13-tridecanolactone. The thermal or photochemical decomposition of ketone peroxides is thought to proceed through homolysis of an oxygen-oxygen bond, while the regeneration of ketone from the photolysis or thermolysis of the peroxides is viewed as a double Beta scission of carbon-oxygen bonds to generate oxygen and two molecules of ketone. The method promises to be a convenient way of preparing musk compounds used in perfumes.

3324 APTIC NUMBER 21596

Story, Paul R., Clyde E. Bishop, John R. Burgess, B. W. Murray, and M. D. Youssefyeh
EVIDENCE OF A NEW MECHANISM OF OZONOLYSIS. J. Am. Chem. Soc., 90(7):1907-1909, March 27, 1968. 8 refs.

Labeled ozonide (cis-trans mixture) was prepared by ozonizing to 90% of completion a solution in pentane (75ml) of trans-diisopropylethylene (130/m moles) and acetaldehyde-018 (88 m moles) at Dry Ice-acetone temperature. The methyl isopropyl ozonide was isolated. Location of the isotopic label was achieved by lithium aluminum hydride reduction of methyl isopropyl ozonide, followed by mass spectral analysis of the only products, ethanol and isobutyl alcohol. Ethanol was found to contain 25.4% oxygen- 18 and the isobutyl alcohol 7.6%. Approximately 32% of the methyl isopropyl ozonide was formed via the Criegee zwitterion mechanism, while the remaining 68% was formed via the monozonide-aldehyde mechanism. Methyllithium

reduction showed that about 77% of the ozonide was formed via the molozonide-aldehyde interchange mechanism. A dependency of ozonide cis/trans ratios on olefin geometry was confirmed. Little, if any steric effect is operative in the hydride and methyllithium reductions.

3325 APTIC NUMBER 20575

Swearingen, J. S.
COMPARE METHANE LIQUEFYING PROCESSES. Hydrocarbon Process, 45(8): 137-140, Aug. 1966. 1 ref.

The thermodynamics of methane liquefaction are examined on the basis of a sample flow scheme involving compression, turboexpansion, and mechanical refrigeration. This design approach is applicable to many cryogenic processes. The scheme analyzed is 41.25% efficient, requiring 510.8 Btu or 352 horsepower or work per million cubic feet per day (105 F starting temperature at atmospheric pressure) to liquefy one pound of methane.

3326 APTIC NUMBER 21165

Swearingen, J. S.
DESIGN CONSIDERATIONS IN LNG EXPANSION LIQUEFACTION CYCLES. Inst. of Gas Technology, Chicago., Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 12 p. 2 refs. (April 7-12, Paper 2-10).

Expansion liquefaction of natural gas must have a good technical and cost basis, and equipment must be available for carrying it out. Current cycles are based on the use of higher pressures so that only a portion of the refrigeration work is done by the expanders, and the expander is arranged to operate with wet exhaust. In one type of cycle the expander circuit has a stream of gas compressed to 1000 psia, cooled in heat exchangers, and expanded; the exhaust is then recycled through the heat exchanger and compressor for repeated processing. Another type of cycle operates on the basis of an available pressure drop in a natural gas stream, while a third type utilizes the available energy for compressing a portion of the stream to a higher pressure so that it can be processed according to the principles of the second type. Several methods are listed for estimating the isentropic enthalpy drop. The preferred form of turboexpander for a moderate sized LNG plant is one which has a single stage of expansion and single stage of compression, the latter for absorbing the expander power. Design criteria and operating variables are described for the turboexpander, and suggestions are made for future improvements.

3327 APTIC NUMBER 21396

Takagi, Seiichi
A STUDY ON THE DECOMPOSITION OF ZINC-FERRITE BY ROASTING. SULPHATIZING ROASTING AND REDUCING ROASTING. Nagoya Kogyo Daigaku Gakuho (Bull. Nagoya Inst. Tech.), vol. 14:365-376, 1962. 47 refs.

Studies of the decomposition of $ZnFe_2O_4$ formed from the powder of ZnO and Fe_2O_3 were carried out by the method of sulfatizing roasting and reducing roasting. The formation rate of soluble zinc is greatest when the ratio of SO_2 to O_2 is 60:40. When this mixed gas is passed through a heated V_2O_5 catalyst, the rate increases markedly; when N_2 gas is added, the rate decreases, but can be increased by adding a moderate amount of vapor. By CO gas reduction, Fe_2O_3 in $ZnFe_2O_4$ is less reducible than Fe_2O_3 only or in the mechanical mixture of ZnO and Fe_2O_3. The deposition rate of carbon by the decomposition of CO gas is, in the case of $ZnFe_2O_4$, remarkably slower than in the case of Fe_2O_3 only or of the mechanical mixture ZnO and Fe_2O_3. Both ZnO in the mixture of ZnO and Fe_2O_3, and ZnO in $ZnFe_2O_4$ can be reduced by CO gas without the addition of C, but the reduction temperature of ZnO in $ZnFe_2O_4$ is much higher than that of ZnO alone. (Author abstract modified)

3328 APTIC NUMBER 21460

Tepper, F., J. King, and J. Greer
MULTICOMPONENT ALKALI-METAL ALLOYS. Nottingham Univ. (England) and British Chemical Society, London (England), Proc. Intern. Symp. Alkali Metals, Nottingha, England, 1966, p. 23-31. 5 refs. (July 19-22)

In view of the potential utilization of alkali metals as reactor coolants and power-conversion system working fluids, experiments were conducted to determine the minimum liquid temperatures in four ternary alkali-metal systems, Na-K-Rb, Na-Rb-Cs, K-Rb-Cs, and Na-K-Cs, and selected physical properties of the system Na-K-Cs. The lowest melting points in the systems Na-K-Rb, Na-Rb-Cs, K-Rb-Cs, and Na-K-Cs were respectively -13, -35.5, -36, and ca -108 to 110 F. In both Na-K-Rb and Na-Rb-Cs systems, a high degree of solid solubility exists, while the K-Rb-Cs system was completely isomorphous. The addition of 2 weight percentage mercury to Na-K-Cs eutectic resulted in a slight increase in freezing point and an increase in the melting point range. Further mercury additions up to 15% did not further alter the freezing point. Vapor pressure, liquid density, compressibility, and liquid viscosity values are given for the Na-K-Cs eutectic.

3329 APTIC NUMBER 21112

Thomas, Jerome F., Mitsuqi Mukai, and Bernard D. Tebbens
FATE OF AIRBORNE BENZO(A)PYRENE. Environ. Sci. Technol., 2(1):33-39, Jan. 1968. 30 refs. (Presented at the Symposium on Photochemical Aspects of Air Pollution, American Chemical Society 152nd Meeting, New York, Sept. 14, 1966.)

The state or phase of the airborne benzo(a)pyrene, factors relating it to its carrier (soot), and its photochemical modification in the airborne state are investigated. When a total combustion effluent was filtered and an aqueous phase condensated, all measurable quantities of BaP were associated with airborne soot; the quantity in the gas phase was insignificantly small. Lack of open-channel porosity, the large concentration of oxygen functional groups on the surface of the soot particle, and the adherence of airborne BaP to the particle in a manner that allows for ready extraction indicate that the BaP and other arenes are primarily adsorbed on the surface of the soot through hydrogen bonding. Analysis of sized fractions using an aerosol spectrometer

prior to extraction indicated that the amount of BaP per unit weight of soot was constant for all particles, and the relative yield of soot per gram of fuel can be predicted from established smoking tendencies of fuels, which in turn can be related to fuel structure. Relatively rapid decrease of BaP on soot may be related to much greater surface exposure to light as investigated by fluorescent techniques, and upon activation by light or heat a complex is formed, possibly a dimer, which locks the C-H out-of-plane vibrations to one side of the plane, resulting in a modified spectrum.

3330 APTIC NUMBER 21278

Hamatsu, Keizo and Wazo Komatsu
IR STUDY OF SYNERGETIC EFFECT ON ADSORPTION OF CARBON MONOXIDE ON NICKEL OXIDE. J. Catalysis, 17(3):398-400, June 1970. 5 refs.

An infrared study of carbon monoxide adsorbed on nickel catalyst was undertaken to test the hypothesis that the synergistic effect of oxide catalysts with different dopents is due to electron rearrangement which occurs when different dopents are brought into contact and in a way that equalizes Fermi levels at the interface. In the experiment, CO at 22 Torr was introduced on nickel oxide coated Aerosol (NiO)(p) and the spectrum recorded at 5 min, 2 hr, and 20 hr after introduction of the gas. Attention was paid exclusively to the change of transmittance at 2060 reciprocal cm. Addition of NiO(Li) and NiO(IN) to NiO(p)) increased and decreased the absorption at this band, respectively. The results, which support the hypothesis, are attributed to the change of the adsorbed amount of CO on NIO(p) due to the addition of the doped oxide. It is assumed that the positive and negative charge will be induced on NiO(p) for the mixtures NiO(Li) and NiO(p), and NiO(IN) and NiO(p), respectively.

3331 APTIC NUMBER 17572

Ulbrich, E. A. and R. A. Jones
SIMULATION LOW-CONCENTRATION CHEMICAL REACTIONS AS IN SMOG. Simulation, 12(4(:185-189, April 1969. 8 refs.

In order to verify the mathematical model from a chemical chamber experiment and to explore the feasibility of modeling chemical reactions by computer, a simulation was performed of the photochemical production of smog components in the presence of ethylene and oxygen. The problem was time-scaled fast by a factor of 1440, so that the 24-hr experiments could be run in one minute. The study using a hybrid computer, was considered a success in that the time histories of the significant measured chamber variables could be reproduced closely. The simulation is considered a valuable tool in two ways: the values of the rate [illegible]ficients can be more closely estimated, and it can be used [illegible]y routine runs in place of the relatively expensive [illegible]ry chamber. The principle criticism of the method is that [illegible]on cannot be proved unique. Additional advantages are [illegible]se, recording of all reactants, and insight into the [illegible]y the application of data gained from a computer [illegible]lso serves to indicate areas for additional research [illegible]story chamber. (Author conclusions modified)

3332 APTIC NUMBER 21171

Umetsu, Yoshiyuki and Shinichiro Suzuki
ON THE DECOMPOSITION OF COPPER FERRITE BY ROASTING IN SO2-O2-N2 ATMOSPHERE. Text in Japanese. Nippon Kogyo Kaishi (J. Mining Met. Inst. Japan), vol. 70:151-154, 1954. 4 refs.

Decomposition of copper ferrite was studied by roasting it in various atmospheres containing sulfur dioxide, oxygen, and nitrogen at 550 to 900 C. The ferrite is decomposed into oxides by heating in an N2 atmosphere. By heating in an SO2 atmosphere, it is decomposed into copper sulfate and minor iron sulfate below 650 C and above 700 C, into oxides. In an SO2-O2-N2 atmosphere, it is decomposed similarly to zinc ferrite, and its decomposition temperature range is controlle/ by the partial pressure of anhydrous sulfuric acid which is secondarily produced by SO2 and O2 in a furnace.

3333 APTIC NUMBER 21465

Vetyukov, M. M. and V. I. Shcherbinin
VISCOSITY AND DENSITY OF EUTECTIC MOLTEN SALT MIXTURES. (Vyazkost' i plotnost' evtekticheskikh smesey rasplavlennykh soley). Text in Russian. Zh. Prikl. Khim., 36(9,11):2385-2391, 1963. 21 refs.

Measurement of the viscosity of eutectic cadmium nitrate-sodium nitrate and calcium nitrate-sodium nitrate melts as a function of temperature, using the torsion pendulum method, revealed that the normal exponential relation does not hold near the crystallization temperatuare of the low-melting component. The activation energy of viscous flow in this temperature range rises until the crystallization temperature of the eutectic is reached. The linear path of the density polytherms is also shifted near the melting point of the low-melting component, in the direction of higher density, though to lesser degree than in the case of viscosity. Viscosities for eutectic NaNO3-potassium nitrate and sodium nitrite-potassium nitrite melts were studied for comparison. The first mixture showed slight deviation from a linear viscosity dependence near the crystallization point for NaNO3; the second mixture closely followed an exponential curve. Experimental data are in good agreement with results from earlier studies of the temperature dependence of electrical conductivity, and viscosity of eutectic mixtures of fused salts, indicating the emergence of a quasieutectic structure in these mixtures near the crystallization point of the low-melting component.

3334 APTIC NUMBER 21521

Walters, W. J. and J. A. Ward
CANVEY ISLAND METHANE TERMINAL. Gas J., 325(5337):50-54, Jan. 19, 1966. (Presented at the IGE, 31st Autumn Research Meet.)

Details are given of the facilities, construction, materials, operation, and problems at the Canvey Island liquid methane terminal in the lower Thames River. The seven tanks have a storage capacity for 22,000 tons of liquid methane, and consist essentially of two concentric tanks with the interspace filled

with insulating material (perlite). The evaporation plant is arranged in three streams, each with a capacity of 50 tons/hr of liquid methane and designed to raise the temperature of the gas to above 0 C. Two separate types of pump with maxium interchangeability were installed, and are so arranged as to have 100% standby capacity for normal outputs. The jetty, which is some 750 ft in length, can accommodate ships of up to 60,000 ton deadweight. Liquid being unloaded from a ship passes through two unloading lines 14-in. in diameter, which rise from the jetty to the tanks to permit boiloff gas to disengage effectively and avoid gas locking. Since the liquid must flow under gravity and it is desirable to minimize losses in pressure and long pipelines, the first-stage pumps are located in the vicinity of the tanks, while the second-stage pumps are located outside the tank area to avoid congestion and raise the pressure to the level required at the inlet to the evaporators. All the low-temperature pipelines are of an aluminum alloy, as are the inner tanks of the storage vessels. Bronze and 9% nickel steel were among other materials used for various bolts, castings, and fittings. Pipelines are insulated with expanded ebonite (Onazote). The methane terminal is operated in conjunction with a liquefied petroleum gas storage equipment and reforming plants on the same site, and certain services and personnel are shared.

3335 APTIC NUMBER 21158

Wood, R. E. and H. L. Ritter
X-RAY STUDIES OF FUSED SALT SYSTEMS. IV. CADMIUM IODIDE.
J. Am. Chem. Soc., vol. 75-471-473, Jan. 20, 1953. 6 refs.

An analysis of the X-ray diffraction pattern of fused cadmium iodide indicates that liquid CdI2 is a curious transition between solid and vapor, exhibiting in major part the octahedral arrangement of the crystal. The Cd atoms appear to lie closer (at about 2.90 A) to two of the I atoms in a octahedron than to the other four. The fact that the Cd atom presumably hinges more or less freely about the I-I axis it lies closest to would permit the CdI2 units to be distinctly insoluble. This indicates a closer approach to pure covalency of the Cd-I bond in the liquid than in the predominantly ionic solid. The sum of the covalent radii for Cd and I is 2.76 A, while the sum of the ionic radii is 3.13 A. The suggested angular CdI2 'molecule', is thus intermediate between the 90 deg configuration in the crystal and the linear molecule found in the liquid. With Cd-I and I-I distances of 2.90 and 4.75, the I-Cd-I angle is 110 deg. At the same time, there is a considerable proportion of linear I-Cd-I molecules.

3336 APTIC NUMBER 21613

Wyatt, P. A. H.
METHODS FOR CALCULATING THE EXTENT OF DISSOCIATION OF COMPOUNDS IN THE LIQUID STATE. Trans. Faraday Soc., vol. 52:806-815, 1956. 21 refs.

A straightforward application of Raoult's law to the dissociation of a compound in the liquid state shows that explicit values of the extent, alpha, of dissociation can be calculated from experimental data or from corresponding vapor-pressure derivatives. When the form of dissociation is uncertain, the quantity alpha (a plus b)/abs can be determined, in which a and b are the numbers of particles produced in solution per molecule of the two primary dissociation products, and s is the number of molecules of the compound involved in the dissociation equation. For compounds of small dissociation, a and b can be evaluated, by a combination of freezing-point (or vapor pressure) and partial molar heat content data, thus supplementing the methods already in use. For compounds of large dissociation, cryoscopic data can be used to test whether or not dissociation is complete. Some nitric and sulfuric acid data are used in illustration of the methods. (Author abstract modified)

3337 APTIC NUMBER 21146

Zellerer, E.
SHELL-STRUCTURE TANKS FOR TRANSPORT OF LNG BY SHIP. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 29p. (April 7-12, Paper 6-37).

Design criteria are presented for transport by ship of liquefied natural gas in shell-structure tanks. The thin curved surfaces of the walls are able to carry the pressures of the liquids or gases more economically than the conventional flat construction. The bottom may consist of the same shell elements as the walls, a conventional plane beam construction, or a thin flat plate which lies flush with the deck or the insulation layer. Shell segments joined together to form a row constitute the tank walls, and as a result the intermediate shell arches have horizontal forces equal and in opposite directions. In the moving state, the equal and opposite acting forces are no longer in equilibrium, and additional bracings are required to support the arch elements. When the distribution of pressure along the meridional section is no longer constant, then the line of support does not coincide with the circular arch and thereby additional bending stresses are introduced in the shell elements. Tilting occurs due to the rolling and pitching of the ship, and acceleration of the liquid that lies within the curved portion of the shells produces bending stresses. Formulae are included to calculate the stresses encountered during transportation by ship and provide the necessary shell thickness.

3339 APTIC NUMBER 21288

Zick, L. P., J. W. Crossett, and W. T. Lankford, Jr.
NICKEL-STEEL TANK TESTS AT MINUS 320. Mech. Eng., vol. 85:40-44, July 1963. 7 refs. (Presented at the American Society of Mechanical Engineers Winter Annual Meeting, 1962, Paper 62-WA-273.)

Full-scale vessel tests show that 9% nickel steel has a notch toughness sufficiently high to permit its use in low-temperature service without stress-relieving after fabrication. Significant economies could be realized, especially in large field-erected vessels, where the cost of stress-relieving is usually prohibitive.

Superior notch toughness can be obtained in 9% nickel steel by a quenching and tempering operation rather than the conventional double-normalizing and tempering treatment. Tests were conducted on a rectangular vessel incorporating design and fabrication features that might be encountered as a tank on a ship for transporting liquid gas.

3339

APTIC NUMBER 20918

Anderson, Sonia R. and Fraldo Antonini
THE BINDING OF CARBON MONOXIDE BY HUMAN HEMOGLOBIN. PROOF OF VALIDITY OF THE SPECTROPHOTOMETRIC METHOD AND DIRECT DETERMINATION OF THE EQUILIBRIUM. J. Biol. Chem., 243(11):2918-2920, June 10, 1968. 22 refs.
CFSTI, DDC: AD 679251

Stoichiometric titrations of human hemoglobin with carbon monoxide show that the interaction of hemoglobin with ligand is accompanied by proportional changes in both the Soret and visible absorption bands. This linearity was observed in neutral solutions, both in the presence and absence of 2 M NaCl, and in alkaline solutions at pH 9.2. It is concluded that the liganded intermediates taking part in the equilibrium do not differ significantly in spectra from the equivalent hypothetical mixtures of reduced and fully liganded hemoglobin. The CO equilibrium determined in dilute hemoglobin solutions (4.5 times 10 to the minus 8th power M to 2.34 times 10 to the minus 7th power M) is characterized by a relatively high Hill constant (2.3) and a free ligand concentration of 4.3 to 5.6 times 10 to the minus 8th power M at 50% saturation. The results are of special interest in light of the sedimentation studies and kinetic experiments which indicate that a strongly ligand-linked equilibrium between dimeric and monomeric (or single chain) hemoglobin predominates in this concentration range. (Author summary modified)

3340

APTIC NUMBER 21276

Ayres, Stephen M. and Meta E. Buehler
THE EFFECTS OF URBAN AIR POLLUTION ON HEALTH. Clin. Pharmacol. Therap., 11(3):337-371, 1970. 108 refs.

The relationship between pollutant emissions, atmospheric cleansing processes, and ambient air pollution is described. A high pollution potential is often produced in late fall and early winter by an anticyclone, associated with fair weather, low wind speeds, and temperature inversions. Toxicological studies involving the administration of sulfur dioxide, nitrogen dioxide, carbon monoxide, and particulate emissions to animals and man are reviewed. They demonstrate that single pollutants cannot explain the irritant potential of the urban atmosphere. A number of epidemiological studies are presented which emphasize the relationship between human illnesses, such as bronchitis, emphysema, and pulmonary edema, and atmospheric pollution. It is concluded from the synthesis of toxicological and epidemiological studies that the noxious nature of the environment is due to a complicated 'mix' of pollutant and meteorological factors. (Author abstract modified)

3341

APTIC NUMBER 21070

Becker, Robert O., Joseph A. Spadaro, and Edward W. Berg
THE TRACE ELEMENTS OF HUMAN BONE. J. Bone Joint Surg., 50-A(2):326-334, March 1968. 28 refs.

Trace elements in human bones of recent origin from Syracuse, N. Y. were analyzed in comparison with specimens of ancient human bones from burial sites in Peru and Pennsylvania, in an effort to distinguish those elements consistently associated with and possibly essential to the matrix from those resulting from dietary and environmental variations. The Pennsylvania sample was about 500 years old, while the Peruvian samples were about 500-600 years old. The tibia or femur was used. After drying-ashing procedures, semiquantitative spectrographic analysis with sensitive direct current arc excitation was employed. The detected elements fell into three groups. The first (copper, zinc, strontium, iron, silicon, vanadium, and aluminum) were detected rather consistently in all specimens, despite such factors as specimen age and soil leaching; some of the these may be functionally important in the matrix. The second group consists of elements sporadically detected, such as manganese, silver, tin, and rubidium; these probably are not essential to bone, but may occur because of local environmental or occupational factors. The third group contains two elements, lead and vanadium, detected in all but one sample but invariably present in very small concentrations (less than 5 ppm) in ancient bone and in much higher concentrations (Pb, 50 ppm; V, 11 ppm) in modern bone. Contemporary air pollution is strongly implicated as the primary cause of this increase.

3342

APTIC NUMBER 20970

California State Dept. of Public Health, Berkeley, Air Pollution Medical Studies Unit
HEALTH EFFECTS OF NITROGEN DIOXIDE AND NITRIC OXIDE. 22p., 1962. 16 refs.

It is indicated that nitric oxide is about one-fourth to one-fifth as toxic as nitrogen dioxide, and data on effects of NO2 on animals led to the present threshold limit of 5 parts per million for industrial workers. Even with exposures to 200 parts per million of NO for four hours, rats showed no evidence of nitric oxide hemoglobin, while between 50 and 75 parts per million of NO2 would produce a fibrotic lesion in laboratory animals which was slowly resolving. Based on lung-to-body weight ratios and pathologic changes, the concentrations of NO2 at which minimal effects occurred in rats were 104, 65, and 28 parts per million for 5, 15, and 60 minutes, respectively. The exposures below which no change in lung-to-body weight ratio can be detected in rats can be presented as
Log (ppm NO2) equals 2.38 - (0.525 log exposure time in minutes). The reports reviewed indicate that experimental exposures to nitrogen dioxide continuously, or exposures to particles on which the gas is absorbed, can produce the characteristic changes that occur in chronic obstructive pulmonary disease: increased secretion, dilatation of bronchioles, and loss of alveolar tissue.

3343

APTIC NUMBER 20919

Carroll, Robert E.
EPIDEMIOLOGY OF NEW ORLEANS EPIDEMIC ASTHMA V. Am. J. Public Health, 58(9):1677-1693, Sept. 1968. 10 refs. (Presented at the Joint Session of the Epidemiology, Engineering and Sanitation, Maternal and Child Health, Occupational Health, and Radiological

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Health Sections of the American Public Health Association at the 95th Annual Meeting, Miami Beach, Fla., Oct. 25, 1967.)

The published literature and recent unpublished findings on the occasional, massive epidemics of asthma experienced in New Orleans since 1953 are reviewed in terms of time patterns, weather, patient population, and geographic distribution. However, the nature of the allergen that causes the episodes remains an enigma. Very sophisticated air sampling for a number of years has failed to produce any consistent findings. Prior hypotheses, implicating burning dumps or dust from a grain elevator, no longer seem tenable. Data from a city-wide telephone survey indicate that the epidemics, instead of being limited to a few hours in duration, may actually last almost a week while affecting different areas of the city. Increases in asthmatic attacks may also be occurring in other Louisiana cities at the same time. A current working hypothesis is that some type of rather specific allergen, probably of natural origin, is present around the city at certain times of the year. With the proper weather conditions, particularly low winds speeds and an inversion, the allergen sinks into the downtown area and concentrates its effects on the population served by Charity Hospital. (Author summary modified)

3344 APTIC NUMBER 21456

Chalmers, J. P., P. I. Korner, and S. W. White
DISTRIBUTION OF PERIPHERAL BLOOD FLOW IN PRIMARY TISSUE HYPOXIA INDUCED BY INHALATION OF CARBON MONOXIDE. J. Physiol. (London), vol. 192:549-559, 1967. 17 refs.

Primary tissue hypoxia was induced by carbon monoxide inhalation, and its effects were studied on the distribution of blood flow in the portal, renal, muscle, and skin beds. Tests were conducted on unanesthetized rabbits, in animals without functioning autonomic effectors (de-efferented rabbits), and in animals with section of the carotid sinus and aortic nerves (de-afferented rabbits). The pattern of blood flow distribution during CO hypoxia was similar in 'de-efferented' and 'de-afferented' animals, suggesting that the effects in the latter were determined by local mechanisms. Susceptibility of the various beds to the local dilation effects of CO hypoxia was markedly different, the greatest effects being noted in the portal bed, followed by skin, kidney, and muscle. In this type of hypoxia, the arterial baroreceptors are probably the main afferent source of reflex activity. In normal animals, reflex constriction effects mainly affect the portal adrenal beds, moderating the local dilator effect of hypoxia. There is vasodilation in muscle, probably the results of adrenalin secretion, but the response in skin is largely determined by the local effects of hypoxia. The total orthosympathetic activity evoked in this type of hypoxia appears to be less than in severe arterial hypoxia. (Author summary modified)

3345 APTIC NUMBER 21457

Cunningham, D. J. C., P. C. Goode, and B. B. Lloyd
DEPRESSION OF VENTILATION AFTER CARBON MONOXIDE. J. Physiol., vol. 191:44-45, March 1967. 2 refs.

Relationships between the partial pressure of oxygen and hemoglobin unsaturation and between the partial pressure of oxygen and the respiratory response to hypoxia are similar. If chemoreceptor activity depended on the degree of unsaturation of an intracellular hemoglobin-like pigment, exposure to carbon monoxide could be expected to lead to a reduced discharge. About 260 cc pure CO was suddenly injected into the inspiratory pathway in four uninformed, moderately hypoxic, hypercapnic subjects. A 20 minute period breathing 5.5% carbon dioxide and 94.5% O2 followed 1-10 breaths later. The subjects detected 18 out of 29 injections. In the first respiratory cycle, after the injection of CO or O2, the CO2 pressure across the veins fell by less than one torr and ventilation fell significantly. With CO, partial arterial pressure of O2 rose by less than 3 torr and there was usually momentary dizziness a few seconds later. With O2, the partial arterial pressure of O2 rose from 55 to 75 torr. The latencies were the same for CO and O2, suggesting that both effects were mediated by the arterial chemoreceptors. It can be argued that the small changes in the CO2 pressure across the veins were not responsible for the effects.

3346 APTIC NUMBER 21346

Deichmann, William B., W. E. MacDonald, W. A. D. Anderson, and F. Bernal
ADENOCARCINOMA IN THE LUNGS OF MICE EXPOSED TO VAPORS OF 3-NITRO-3-HEXENE. Toxicol. Appl. Pharmacol., 5(4):445-456, July 1963. 9 refs.

Swiss mice (20 males and 20 females) were exposed for 6 hours per day on 5 days of the week to a mean vapor concentration of 0.2 ppm of 3-nitro-3-hexene. Exposure of one-half of these mice was in an atmosphere of 49% relative humidity, the exposure of the remaining mice was in an atmosphere of 90% of saturation. Another group of 40 mice were maintained under identical conditions, but they were not exposed to the olefin. In the experimental animals signs of irritation of the mucous membranes, eyes, and upper respiratory tract were minimal. Most of the early deaths resulted from fighting, and possibly because of a bacterial infection. The fatalities occurred to about the same extent in all groups. Pathologic tissue changes in the 27 autopsied experimental mice which survived from a minimum of 128 (over 188 days) to a maximum of 302 exposures (over 439 days) were minimal and nonspecific in all except in five animals. Adenocarcinoma of the lung was noted in four mice, two males and two females exposed at 49% relative humidity, and in one female mouse exposed at 90% relative humidity. An adenoma of the lung was noted in one of a total of 23 autopsied control mice maintained for the same period of time under similar conditions, but not exposed to the nitro-olefin. Signs suggestive of bacterial infection were seen in all experimental and control groups, and bacterial infection cannot be ruled out as a contributing factor. (Author summary modified)

3347 APTIC NUMBER 21365

Dillmann, G., D. Henschler, and W. Thoenes
EFFECTS OF NITROGEN DIOXIDE ON LUNG ALVEOLI OF MICE. MORPHOMETRIC-ELECTRON MICROSCOPIC STUDIES. (Stickstoffdioxydwirkungen an der

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Dillmann, G., D. Henschler, and W. Thoenes
EFFECTS OF NITROGEN DIOXIDE ON LUNG ALVEOLI OF MICE. MORPHOMETRIC-ELECTRON MICROSCOPIC STUDIES. (Stickstoffdioxydwirkungen an der

Lungenalveole der Maus. Morphometrisch-elektronenmikroskopische Untersuchungen) Text in German. Arch. Toxikol. (Berlin), vol. 23:55-65, 1967. 36 refs.

Repeated exposure to nitrogen dioxide results in a tolerance which had previously been assumed to be an edematous drenching of the alveolar septa, inhibiting further diffusion of the gas. To evaluate this more clearly, morphometric studies were conducted on the lungs of two normal mice and two that had been exposed to 35 ppm NO2 for six hours. Corresponding parts of the right inferior lobes were screened under the light microscope and, on the basis of identical degrees of lung parenchyma distention, chosen for electron microscope studies. In the mice that had become tolerant to NO2, the arithmetical mean thickness of the air-blood barrier showed an increase of 1.5 times that of normal. This distance represents the thick areas of all the tissue elements between an alveolus and a capillary. The harmonic mean of the barrier thickness, which includes the thinnest parts, was unchanged. Analyzing the relative frequency of the three cell types normally present in lung parenchyma, it was found that their distribution had not changed significantly. Since no interstitial edema could be found, these studies indicate that it is the volume of the cells in the alveolar septa which increases. (Author summary modified)

3348 APTIC NUMBER 21335

Doerre, Werner
MODEL CONCEPTIONS OF THE POSSIBLE SIGNIFICANCE OF SOME PHYSICAL-CHEMICAL PARAMETERS OF ATMOSPHERIC DUST FOR ITS BIOLOGICAL EFFECT, ESPECIALLY FOR THE ORIGIN OF BRONCHOGENIC CARCINOMATA IN MAN. (Modellvorstellungen zur moeglichen Bedeutung einiger physikalisch-chemischer Parameter des atmosphaerischen Staubes fuer seine biologische Wirkung, insbesondere fuer die Bronchialkarzinomentstehung beim Menschen). Text in German. Wiss. Z. Humboldt-Univ. Berlin Math. Naturw. Reige, 18(1):75-82, 1969. 17 refs.

The retention of a dust consisting of an inert, difficulty soluble part and a soluble, biologically effective substance after inhalation on the various regions of the respiratory tract was calculated on the basis of the Landahl-Jacobi model of the respiratory tract. The model aerosol was described by the following parameters: grain size distribution, mass concentration, and spherical particle shape. The biologically effective substance was assumed to be proportional to the particle surface and to the mass of particles. The retention was measured by the amount of biologically effective substance desorbed per unit of area and time. In most cases, the maximum strain was taken by the bronchial region, regardless of whether the dust penetrated readily into the lungs or not. The applicability of the model for estimating the effect of carcinogens adhering to dust was shown. The maximum strain retention was again on the bronchi. The solubility of the carcinogens in the body fluid and the description and elimination speed are decisive for the development of bronchial carcinoma.

3349 APTIC NUMBER 20953

Dowell, A. R., L. A. Lohrbauer, D. Hurst, and S. D. Lee
RABBIT ALVEOLAR MACROPHAGE DAMAGE CAUSED BY IN VIVO OZONE INHALATION. Preprint, Duke Univ. Durham, N. C., Dept of Medicine, Aerospace Medical Research Lab., Wright-Patterson AFB, Ohio, and National Air Pollution Control Administration, Cincinnati, Ohio, Biochemistry Section 24p., 1969. 24 refs.

To investigate the decreased resistance to lung infection observed in some laboratory animals exposed to ozone, the osmotic fragility of alveolar macrophages recovered from ozone-exposed rabbits was determined using a fragiligraph. Ozone concentrations employed were 10 ppm for 3 hours and 2 and 0.5 ppm for 8 hours per day in either chornic or acute time periods. Lung lavage resulted in smaller recoveries of lung cells from rabbits exposed to 10 ppm ozone for 3 hours, and the percentage of macrophages was decreased. Low-dose exposures for a week (2 - 0.5 ppm for 8 hours per day) did not affect the total number of recoverable lung cells, but did result in increases in the percentage of neutrophils. The average time in minutes for complete lysis of control alveolar macrophages was 33.0 plus or minus 6.5 and 24.0 plus or minus 2.2 for the cells from rabbits exposed to the 10-ppm concentrations. Complete lysis times for the cells subjected to 2- and 0.5-ppm exposure were 25.2 plus or minus 5.4 and 33.3 plus or minus 7.5, respectively. These changes in macrophage osmotic fragility occurred in the absence of detectable lipid peroxidation.

3350 APTIC NUMBER 20482

Ekman Gosta, Birgitta Berglund, Ulf Berglund, and Thomas Lindvall
PERCEIVED INTENSITY OF ODOR AS A FUNCTION OF TIME OF ADAPTATION. Scand. J. Phychol., vol. 8:177-186, 1967. 29 refs.
CFSTI, DDC: AD 678298

Two experiments were conducted to determine the perceived intensity of odor under conditions of constant stimulation with hydrogen sulfide. The H2S concentration in the first experiment was 0.7 ppm and in the second, it varied (0.9, 2.6 or 6.8 ppm). The experimental temperature was 21 plus or minus 1 C; relative humidity was 50 plus or minus 5%. Since in such experiments no perceptually constant standard can be presented within the same sense modality during adaptation, a two-step scaling procedure was developed. The first step was a cross modality matching procedure; the second, the numerical scaling of the matching continuum. Perceptual intensity decreased exponentially as the time of stimulation increased. An exploratory investigation was also made of the process of recovery of sensitivity after stimulation had ceased. Preliminary results indicate that almost complete sensitivity is regained in about 3-4 minutes; the general trend is one of a negatively accelerated growth function.

3351 APTIC NUMBER 21307

Ellis, Richard P. and Ronald M. Bishop
OXIDES OF NITROGEN ARE HEALTH HAZARDS. J. Environ. Health, 32(6):676-677, May/June 1970. 8 refs.

Oxides of nitrogen are extremely toxic. Nitrogen dioxide and

tetroxide are most prevalent. Both the threshold limit value and ceiling are 5 ppm and should never be exceeded. Occupational exposure is encountered in nitric acid manufacture, nitration of cellulose and inorganic materials, etching, pickling of metals, certain welding operations, explosives manufacture and use, and engine exhausts. The gas combines with water to form nitrous and nitric acid which, in turn, react with salts in the tissues of the respiratory tract to produce irritating nitrites and nitrates. Exposure to high concentrations may be fatal. Persons suspected of having been exposed should be kept under observation at rest for 25 hours. Persons known to have been exposed should be hospitalized at bed rest. Administration of oxygen and corticosteroids is indicated and may be life-saving.

APTIC NUMBER 20969

3352

Frey, Allan H.
ELECTRICAL CHARGE DISTRIBUTION AND OLFACTORY METHODOLOGY AND THEORY. Psychol. Bull., 69(6):390-395, 1968. 23 refs.
CFSTI, DDC: AD 674227

The static electrical charge on the subjects, equipment, walls, and odorant have had an effect on the results of a number of olfactory experiments. The nature of airborne charge complexes is considered, together with their biological effects and methodology for the measurement and control of this variable. Experimenters should consider the following procedures: all subjects should be electrically grounded; human subjects should wear only cotton clothing, and some consideration should be given to washing animal subjects in an antistatic solution; all subjects should be in a Faraday cage, or part of it; and measurement should be made and reported of the charge on the odorant, which can be done by using a Beckett probe. The olfactory epithelium is a sheet of special sensory cells with very thin cilia protruding into the overlying mucous layer, and these cilia and the membrane can be affected by charge complexes. The finding that all the physiological effects of a positive carbon dioxide ion on the trachea can be duplicated by the intravenous injection of 5-hydroxytryptamine further suggests some reason for considering the possibility of chemical change in the olfactory epithelium as a function of the charge on the odorant. Other factors for consideration result from the hypothesis that negative ions modify brain 5-HT levels causing a tranquilization effect, and that X-radiation of animals has a behavioral effect which is mediated by the olfactory system.

APTIC NUMBER 20525

3353

Gardner, Donald E., Robert S. Holzman, and David L. Coffin
DEPRESSION OF PHAGOCYTOSIS BY SULFAMETHAZINE. J. Bacteriol., 96(1):274-275, July 1968.

Studies have shown that air pollutants depress phogocytic ability of the pulmonary alveolar macrophages. Rabbits were randomly assigned either to tap water or tap water containing sulfamethazine (0.77g/liter) ad libitum for a period of 1 week. They were then anesthetized, and 1 ml of a concentrated suspension of washed beta-meolytic, group C Streptococcus pyogenes was injected intratracheally. After 30 min, the animals were sacrificed, the trachea cannulated, and the lungs lavaged three times with warm buffered-saline solution, pH 7.2. Sulfamethazine treatment caused a two-fold increase in the proportion of cells not ingesting bacteria.

APTIC NUMBER 21359

3354

Gesteland, Robert C.
CHEMICAL RANGING AND TRACKING. (FINAL REPORT). Northwestern Univ., Evanston, Ill., Dept. of Biological Sciences. Army Research Office, Grant DA-ARO-D-31-124-G991, Proj. 20061102A328, Rept. 7823.1-RT, 54p., July 31, 1969. 28 refs.
CFSTI, DDC: AD 698581

Significant advances in understanding the chemical basis of the olfactory receptor mechanism, and in relating the signalling parameters of nervous activity to receptor stimulation, have been made. A comparative histological study has turned up a vertebrate nose with very large receptor cells, which should allow the monitoring of cell function with intracellular micro-electrodes for the first time; several methods have been developed for using an electrochemical cell as an indicator of the presence of trace contaminants in a flowing stream. Based on the consensus of recent literature, all cells in the Necturus olfactory epithelium are of the order of 30 times larger in volume than those in the frog olfactory region, making Necturus a good candidate for intracellular recording. The receptor sites for odors in the olfactory mucosa are probably proteins and/or the permeability change producing the electro-olfactogram involves protein components of the membrane. It is possible that stimulus molecules are strongly bound upon reaching the receptors and are removed only by a very long time-constant biochemical process, for instance sloughing or readsorption of the stimulus molecule bound to a macromolecular component of the membrane or a very slow removal of the stimulus molecule from the membrane binding substance. It may be that chemo-reception in the frog's nose is an irreversible process and requires synthesis of new receptor sites to replace those used up by reaction with the incoming stimulus. Use of the high sensitivity of the polarized electrode is still being investigated to trace impurities to detect the presence of contaminants in solution in a sampling cell, and most of the work completed is concerned with cell design and measurement techniques. (Author abstract modified)

APTIC NUMBER 20688

3355

Gross, Paul, Robert T. P. deTreville, Lewis J. Cralley, William T. Granquist, and Fred L. Rundsack
THE PULMONARY RESPONSE TO FIBROUS DUSTS OF DIVERSE COMPOSITIONS. Am. Ind. Hyg. Assoc. J., 31(2):125-132, March-April 1970. 8 refs.

Fibrous quartz, chrysotile asbestos, and tremolite talc dust of respirable particle size, injected intratracheally into rats, produced polypoid proliferative inflammations within smaller air-conducting tubes, and also in more peripheral areas. With time, the inflammatory tissue became converted into collagenous

scars which often caused permanent deformaties of bronchi and bronchioles. Synthetic chrysotile, ceramic aluminum silicate, silicon carbide, glass, and brucite were also introtracheally injected. The main pulmonary response was a marcrophage reaction with minimal stromal participation. Within four days after the injection, foci of polypoid proliferative inflammation were seen, limited to the peripheral respiratory bronchiole and alveolar ducts. Because these polypoid lesions did not collagenize and did not destroy the anatomic integrity of the air spaces, and because they were reversible, the dusts causing this type of response are classed as biologically 'inert'. These lesions are believed to be artifactual in the sense that their production is determined by the method of introducing the dust into lungs, since such lesions are not seen in animals inhaling high concentrations of the same dusts. (Author abstract modified)

3356 APTIC NUMBER 21336

Grosser, Peter-Juergen
THE IMPORTANCE OF EPIDEMIOLOGICAL METHODS FOR COMMUNITY HYGIENE DEMONSTRATED AT THE EXAMPLE OF THE HYGIENE OF AIR POLLUTION. (Die Bedeutung epidemiologischer Methoden fuer die Kommunalhygiene, dargestellt am Beispiel der Lufthygiene). Text in German. Wiss. Z. Humboldt-Univ. Berlin Math. Naturw. Reihe, 18(1):69-74, 1969. 38 refs.

The concentration of pollutants in the atmosphere is generally low (1 ppm and less). The pollutants are either solid, gaseous, or liquid. They vary qualitatively and quantitatively with time and space, so that long-term measurements are required to obtain an idea of the extent of pollution. Because of this variability, it is difficult to assess the actual danger to humans. The increased mortality during the smog episode in London of 1952 became apparent only weeks after the catastrophe at a routine evaluation. The normal death rate was exceeded by 4000. Study of the life-expectancy of humans revealed that it is sometimes 4 to 5 years less in heavily polluted industrial centers. For instance, in the industrial center of Most (Bohemia), the life-expectancy for men is lower by 4 years than in other Bohemian areas. Study of the mortality rate showed that a close relationship exists between diseases of the respiratory tract and air pollution in general, and smoke and sulfur dioxide specifically. Significant correlations were found between bronchitis and pneumonia and the concentration of smoke and SO2. The German Democratic Republic plans to erect a measurement grid for air quality measurements over the entire Republic. In connection with the study of the health records of various groups of the population, it will be feasible to determine the correlation between air pollution and the health of the population.

3357 APTIC NUMBER 21224

Gruenberg, W.
INVESTIGATIONS ABOUT THE HEAVY METAL CONTENTS (COPPER, ZINC, MANGANESE) IN THE ORGANS, THE BLOOD AND THE MILK OF HOGS. (Untersuchungen ueber den Schwermetallgehalt (Kupfer, Zink, Mangan) der Organe, des Blutes und der Milch beim Schwein). Tieraerztlichen Hochschule, Vienna (Austria), Inst. fuer Pathologie und Gerichtliche Tierheilkunde, 1960 (?). 162 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 60p., May 22, 1969.

The copper, zinc, and manganese concentrations of the liver, and in some cases the kidneys and pancreas of 78 pigs were determined to evaluate their relationship with anemia and other diseases affecting pigs. The copper concentrations in the organs of animals sent in for autopsies were markedly less than in those of healthy pigs. Young animals always had higher concentrations of copper in their organs than older animals. In the blood plasma, more than 10% of the total copper content is free, i.e., not a constituent of caeruloplasmin. The spleen contained about 0.42 to 0.55 ppm copper. The zinc concentrations in the organs showed no relationship with pathological-anatomical findings. Younger animals seemed to have higher zinc concentrations in their organs than older animals. The zinc concentration in the organs of three pigs afflicted with parakeratosis was not reduced. The zinc concentration in the blood plasma of pregnant pigs seemed to be somewhat higher. From the investigations performed so far on the heavy metal deficiencies in ashed organs, no rules or relationships could be deduced. Further work should clarify the role copper plays in the anemia of piglets. Further attention should be paid to the zinc concentrations in organs and their significance for parakeratosis. Presently, the manganese metabolism in pigs deserves only minor attention.

3358 APTIC NUMBER 20533

Guarneri, Joseph J. and Gustave A. Laurenzi
EFFECT OF ALCOHOL ON THE MOBILIZATION OF ALVEOLAR MACROPHAGES. J. Lab. and Clin. Med., 72(1):40-51, July 1968. 30 refs.

The effect of alcohol on the numbers and viability of alveolar macrophages in the lungs of mice was measured by combining techniques for quantitating the pulmonary clearance of bacteria and alveolar macrophage harvest. The inhalation of staphylococci provoked a brisk 2.5-fold increase in the numbers of alveolar macrophages. Within 15 min after bacterial deposition, the numbers dropped 35%, but the elevated levels were restored at 30 min and then maintained for a 4-hr period. In contrast, animals given ethanol immediately after bacterial exposure failed to show recovery after the initial drop in macrophage numbers. These data demonstrate that alcohol has a deleterious effect on the mobilization of alveolar macrophages, namely, the maintenance of a macrophage response in relation to a bacterial challenge. Alcohol had no effect on the morphologic characteristics, viability, and numbers of macrophages under basal conditions and the morphology and viability of provoked (mobilized) alveolar cells. These results are correlated with the demonstrated interference of ethanol with bacterial clearance and other experimental and clinical evidence of the adverse effects of alcohol on pulmonary function. (Author abstract modified)

3359 APTIC NUMBER 20473

Nagihara, Tadafumi, Masahito Okayasu, Shigenori Nakajima, Hiroshi Fukaya, Shin Kitamura, and Nobuko Ohata
STUDIES ON THE ABSORPTIVE CAPACITY OF THE BRONCHIAL MUCOUS

MEMBRANE BY RADIOISOTOPE IN RESPIRATORY DISEASES. Nippon Univ. J. Med., 9(2):145-155, June 1967. 17 refs. (Presented at the 9th Annual Meeting of International Chest Diseases, Copenhagen, Denmark, 1966.)

Radioisotopes were introduced into the bronchial lumen in patients with various broncho-pulmonary diseases; blood radioactivity curves were then plotted to calculate absorptive half time as an index of the absorptive capacity of the bronchial mucous membrane. Normal absorption time was rapid, averaging 1 min 20 sec and indicating the high absorptive capacity of the normal membrane. Reduced absorptive capacity was noted, in order of increasing reduction, in bronchial asthma, lung cancer, pulmonary emphysema, pulmonary abscess, pulmonary tuberculosis, and, to a very marked degree, in sacculated bronchiectasis. Thus, asthmatics maintained a relatively high absorptive capacity, although a tendency toward a slightly greater decrease was observed during attacks. During these attacks, absorptive capacity decreased with a greater degree of dyspnea and large amount of sputum, but showed no correlation with coughing. Administration of drugs inhibiting bronchiectasis and asthma generally improved absorptive capacity, suggesting the reversibility of pathologic changes in asthma; it appears that reduced severity of the asthma attacks is closely related to an improved absorptive capacity of the bronchial mucous membrane.

3360 APTIC NUMBER 20535

Hitosugi, Masaharu
EPIDEMIOLOGICAL STUDY OF LUNG CANCER WITH SPECIAL REFERENCE TO THE EFFECT OF AIR POLLUTION AND SMOKING HABIT. Bull. Inst. Public Health (Tokyo), 256, 1968. 8 refs.

In 1965, a field epidemiological survey was conducted in Amagaski and Nishinomyia to determine the effects of air pollution and smoking on lung cancer. Standardized questionnaires were used to obtain detailed histories of smoking, occupation, and medical background for lung cancer cases and also for 4500 adults, aged 30-75, randomly selected from the two cities. Each city was classified into three areas according to the level of air pollution as determined by measurements of dust fall, sulfur dioxide, suspended particulates, trace elements, and aromatic hydrocarbons. The rate of lung cancer mortality in each area was analyzed in relation to the degree of cigarette smoking. A cross-tabulation between the level of air pollution and the number of cigarettes smoked per day revealed a higher death rate from lung cancer among heavy smokers in each area. The death rate from lung cancer increased slightly with increased air pollution among smokers but not among nonsmokers. Regardless of the degree of pollution in an area, a clear-cut dose-effect relationship was observed between the lung cancer death rate and the total number of cigarettes smoked in a lifetime. The results are compatible with the hypothesis that, in Belfast, two-thirds of the lung cancer deaths among men were due to cigarette smoking and one-third to air pollution by smoke. (Author abstract modified)

3361 APTIC NUMBER 20990

Hursh, J. B and T. T. Mercer
MEASUREMENT OF PB212 LOSS RATE FROM HUMAN LUNGS. J. Appl. Physiol., 28(3):268-274, March 1970. 17 refs.

Experiments were performed in which four human subjects were administered Pb(212) by mouth inhalation and by intravenous injection. Blood, urine, and fecal samples were collected. Pb(212) inhaled on natural aerosols showed lung depositions of 27-62% the amount depending on well-characterized aerosol size differences. The loss rate from the lung measured by in vivo gamma counting, as corrected for extralung activity in the lung survey field, had a half-time of from 10.5 to 11.5 hours. Twenty-four hour urinary lead excretion after intravenous injection was from 2.6 to 6.6% of the dose. Fecal collections (34 - 48 hr) yielded 0.2 - 2.7% of the dose. (Author abstract)

3362 APTIC NUMBER 20705

Ishikawa, Hiroya
EFFECTS OF CARBON MONOXIDE ON ELECTRICAL ACTIVITY OF THE BRAIN: COMPARATIVE STUDIES ON ASPHYXIA, N2-INHALATION AND CO-INHALATION (Issankatansoqasu no daino denkikatsudo nioyobosu eikyo. Chissoku, chissoqasku oyobi issankatansoqasu kyunyu niyoru anoxia no kikaku). Text in Japanese. Kumamoto Igakkai Zasshi (J. Kumamoto Med. Soc.), 43(10):870-884, Oct. 25, 1969. 22 refs.

In a study of the mechanism of acute carbon monoxide poisoning, three types of anoxia were induced in immobilized cats: anoxia due to stopping the pump for artificial respiration, anoxic anoxia due to inhalation of pure nitrogen, and anoxia due to inhalation of pure carbon monoxide gas. Spontaneous electroencephalograms and evoked potentials were recorded for each type of anoxia and compared. Survival rates were shortest for CO inhalation and longest for asphyxia. Recovery time was shortest for N2 inhalation and longest for CO inhalation. When Po2 fell to 20 mm Hg, the spontaneous electroencephalograms in asphyxia, N2 inhalation, and CO inhalation disappeared. As CO inhalation progressed, Po2 increased momentarily, but the frequency and amplitude of the spontaneous electroencephalograms decreased. In asphyxia and N2 inhalation, the positive component of the evoked potential persisted longer than the negative component. When asphyxia and N2 inhalation were terminated, the evoked responses reappeared in the reverse order. In CO inhalation, both the positive and negative components disappeared and reappeared simultaneously. Evoked potentials in CO inhalation survived longer in deeper brain regions than in cortical regions; upon termination of the exposure, the potentials reappeared more quickly in the cortical area than in the deeper region. However, the spontaneous electroencephalograms reappeared sooner than the evoked potentials.

3363 APTIC NUMBER 21225

Johnson, Kenneth D.
THE BERYLLIUM OXIDES OF PROPELLANT FUME: OUR KNOWLEDGE OF THEIR PHYSICO-CHEMICAL AND TOXICOLOGICAL PROPERTIES. Preprint, Armed

Services Explosives Safety Board, Huntsville, Ala. 22p., 1966. 16 refs. (Presented at the Armed Services Explosives Safety Board, Explosive Safety Seminar on High Energy Propellants, 8th, Huntsville, Ala., Aug. 9-11, 1966.)

The National Research Council standards for exposure to beryllium oxide arising from rocket motor firing are reviewed and their applicability to actual test firings evaluated. Three considerations were the physical and chemical properties of the two reference oxides specified in the standards; the reasons for the selection of these particular forms of the oxide as reference compounds; and the similarity of propellant combustion oxides to them. Several series of toxicological tests on dogs and rabbits using rocket combustion products are reviewed. It is concluded that not enough is known concerning the relationship between physico-chemical properties of the exhaust oxide and the parameters of motor burning to permit the application of the proposed 'relaxed' standards to be applied. However, it will be difficult to predict that a test can be conducted in conformance with National Research Council standards. Neither will it be possible, with assurance, to demonstrate, on a posterior basis, that these standards have in fact been met.

3364 APTIC NUMBER 21227

Jonek, J., G. Jonderko, and M. Krauze
HISTOCHEMICAL STUDIES OF THE DISTRIBUTION AND ACTIVITY OF THE 5-NUCLEOTIDASE, ADENOSINETRIPHOSPHATASE, ACID PHOSPHATASE, ACID DESOXYRIBONUCLEASE, ALKALINE PHOSPHATASE AND OF THE UNSPECIFIC ESTERASES IN THE LIVER AFTER EXPERIMENTALLY-INDUCED MANGANESE POISONING. (Histochemische Untersuchungen ueber die Lokalisation und Aktivitat der 5-Nukleotidase, Adenosintriphosphatase, sauren Phosphatase, sauren Desoxyribonuclease, alkalischen Phosphatase und der unspezifischen Esterasen in der Leber bei experimenteller Manganvergiftung). Intern. Arch. Gewerbepathol. Gewerbehyg. (Heidelberg), vol 21:241-245, 1965. 17 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 20p., June 27, 1969.

Histochemical studies were conducted on the activity and distribution of some enzymes in the liver of seven male rabbits after manganese poisoning. The activities of the alkaline phophatase and adenosinetriphosphatase increased. For alkaline phosphatase, the highest enzyme activity was found in the central sections of the liver lobules. The adenosinetriphosphatase activity seemed to be strongest in the periphery from where it decreased toward the central vein. The 5-nucleotidase and the desoxyribonuclease showed an individual reduction of their activity. The acid phosphatase and the unspecified esterases increased their activity. The activity increase of acid phosphatase and the occurrence of coarse and diffuse reaction products may indicate degeneration processes in the cytoplasm. The enzymatic changes are linked with disorders of the metabolism. (Author summary modified)

3365 APTIC NUMBER 21455

Keplinger, M. L.
EFFECTS FROM REPEATED SHORT-TERM INHALATION OF FLUORINE. Toxicol. Appl. Pharmacol., vol. 18:192-200, 1969. 10 refs. (Presented at the Soc. of Toxicology, 7th Annu. Meet., Washington, D. C., 1968.)

Mice, rats, and rabbits were exposed to fluorine for 5, 15, 30, or 60 minutes at intervals ranging from 24 hours to one week; animals were sacrified immediately after the last exposure, or at 7, 14, 21, or 45 days after the last exposure. A single exposure caused marked changes in the lungs and some changes in the liver and kidneys. After four exposures to the same concentration, the lungs had slight changes; livers were normal. Kidneys showed slight changes at 7 and 14 days, but were normal at 21 and 45 days. Therefore, four exposures to fluorine caused no more damage than a single exposure to the same concentration. Repeated exposures were made with different concentrations during each exposure. A low, apparently harmless level was used first; then 4, 24, and 96 hours later, the LC50 of fluorine was determined. The LC50's of pre-exposed animals were higher and there was less lung damage than in control animals. Exposures to a low concentration were also repeated every third day. At 1, 3, and 7 days after the last exposure the LC50's were determined. Even at 7 days the pre-exposed animals had higher LC50's and showed less lung edema than animals that were not pretreated by previous fluorine exposure. There may be some type of tolerance or protection developed by exposures to low fluorine concentrations. (Author abstract modified)

3366 APTIC NUMBER 20968

Klurfeld, Gregor and Roger P. Smith
EFFECTS OF CHLORIDE AND BICARBONATE ON METHEMOGLOBIN REDUCTION IN MOUSE ERYTHROCYTES. Biochem. Pharmacol., vol. 17:1067-1077, 1968. 19 refs. (Presented at the Fall 1967 meeting of the American Society for Pharmacology and Experimental Therapeutics, Washington, D. C.)

That methemoglobinemia generated by phenylhydroxylamine persists longer in mouse red cells suspended in Krebs-Ringer-phosphate-glucose than in vivo or in shed blood has been traced to differences in extracellular ionic concentrations. Heparin or bovine serum albumin added to K-R-PO4-G did not shorten the duration of the methemoglobinemic response to phenylhydroxylamine, and phosphate added to shed blood did not prolong it. When a Krebs-Ringer-bicarbonate-glucose medium was used instead of K-R-PO4-G, the pattern of the methemoglobinemic response to phenylhydroxylamine was altered to resemble that of shed blood. When methemoglobinemic cells originally exposed to nitrite are washed, methemoglobin reductase activity, as assessed by net decreases in methemoglobin concentration, is inversely related to the extracellular chloride concentration. Rates of methemoglobin reduction were not influenced by changes in red cell volume as modified by alterations in extracellular osmolality. The addition of bicarbonate to a chloride-free medium did not further stimulate

reductase activity, but in the presence of a critical extracellular chloride concentration, bicarbonate stimulates methemoglobin reduction. Since these effects are still seen when lactate is substituted for glucose, they are apparently mediated through the spontaneous NADH-linked reductive system (diaphorase). These findings suggest that the chloride shift may regulate the rate of methemoglobin reduction in mouse red cells. (Author abstract)

3367 APTIC NUMBER 21710

Kolchinskaya A. Z.
RESPIRATORY CONTROL IN CHILDREN AND TEEN-AGERS. (Pro regulyatsiyu legenevoy ventilyatsiy u ditey i pidlitkiv). Text in Ukrainian. Fiziol. Zh. (Kiev), 16(2):237-249, 1970. 111 refs.

Respiration in some 500 children and teen-agers was investigated under conditions of rest, excercise, hypoxia, and hypercapnia. Adjustments of ventilation to metabolic requirements are discussed, as well as mechanisms that serve to change respiratory rate and volume in the process of growth and development. A hypothetical functional diagram is presented as a basis for a mathematical model of respiratory control: the various parameters include partialasterial pressures of O2 and CO2, arterial blood pH, exercise stimuli, sympathetic and conditioned reflexes. Higher respiratory rate in children is seen as a function of higher oxygen consumption and smaller alveolar capacity. It is proposed also that hypoxic and hypercapnic drives operate in a 'self-learning' process that leads to improve respiratory efficiency as the child matures.

3368 APTIC NUMBER 20621

Kotin, Paul and Hans L. Falk
ATMOSPHERE POLLUTANTS. Ann. Rev. Med., vol. 15:233-254, 1964. 109 refs.

The effects of acute air pollution disasters on morbidity and mortality are documented, and observations during and following these episodes serve as guidelines for research aimed at determining whether sub-lethal or even sub-threshold levels of air pollution represent a hazard to health. Analysis of the Meuse Valley, Poza Rica, Donora, and 1952 London episodes reveals that the aged and persons with chronic cardiac or respiratory disease are at maximum risk as their threshold of response is lower, and the frequent association of fog with atmospheric stasis suggests that both gases and aerosols contribute to the morbidity with the latter having a more pronounced effect. The chronic and intermittent subdisaster exposures of Los Angeles, Tokyo-Yokohama, and New Orleans are investigated in relation to symptoms produced, and the pathological effect of air pollutants is discussed in terms of their physical and chemical state in the atmosphere.

3369 APTIC NUMBER 20691

Lambert, P. M. and D. D. Reid
SMOKING, AIR POLLUTION, AND BRONCHITIS IN BRITAIN. Lancet, 1(7652):853-857, April 25, 1970. 14 refs.

A postal survey of the prevalence of respiratory symptons was conducted in a large sample of the British population. Analysis of the 9975 replies from men and women aged 35 to 69 showed satisfactory agreement with Census and other data. Increasing prevalence with aging and cigarette consumption was confirmed. A male excess is seen in both smokers and non-smokers. Urban/rural gradients are not explained by smoking differences alone. Prevalence rates for symptoms rise with increasing air pollution levels independent of cigarette consumption. Without smoking, local pollution seems to have little effect. In smokers, however, high pollution levels are assocaited with more frequent respiratory symptoms. The frequency of bronchitis increases with age among smokers in the more polluted districts. (Author summary modified)

3370 APTIC NUMBER 20618

Laurenzi, Gustave A., Sam Yin, and Joseph J. Guarneri
ADVERSE EFFECT OF OXYGEN ON TRACHEAL MUCUS FLOW. New Engl. J. Med., 279(7):333-339, Aug. 15, 1968. 23 refs.

The effect of oxygen on tracheal mucus flow was measured by a technique in which artificial particles were deposited on the tracheal mucosa of anesthetized cats and their cephalad progression directly observed. Test particles, prepared by mixing 2 parts of carbon particles with 1 part of lycopodium spores, were injected in small quantities into the tracheal lumen at its most distal point of exposure, and measurements were made of the time to move a distance of 2 mm. Gases were administered humidified at 3 liters per minute; control measurements were made while the animals breathed compressed air for 20 minutes, then test gases were introduced for 20 minutes, and, whenever possible, the animals were re-exposed to compressed air to determine the reversibility of effects. Any change from ambient oxygen tension in the inspired air, high or low, had an adverse effect on particle transport [illegible] oxygen caused a marked prolongation of transport t[illegible] of a 37% decrease in flow rate. Aerosolized racemic epinephrine, subcutaneous epinephrine, and aerosolized adenosine triphosphate, administered for 20 minutes during the inhalation of the various oxygen concentrations and combinations, completely prevented any changes in particle transport, and in some cases they improved basal transport time. These results, which are interpreted in terms of inhibition of carbohydrate metabolism by oxygen and the positive effect of catecholamines on this function, suggest a subtle, but potentially dangerous, form of oxygen toxicity. (Author abstract modified)

3371 APTIC NUMBER 21226

Lehman, Arnold J., Horace W. Gerarde, Verald K. Rowe, Henry F. Smith, Jr., Herbert E. Stokinger, and William L. Sutton
AIR QUALITY CRITERIA FOR BERYLLIUM AND ITS COMPOUNDS. National Academy of Sciences-National Research Council, Washington, D. C.,

Committee on Toxicology and the Advisory Center on Toxicology. Contract NJonr-291(61), 13p., March 1, 1966.

The toxicity and hazards of beryllium and its compounds were studied to obtain a data base from which to make recommendations for the establishment of air quality criteria. The toxic effects, including both acute and chronic beryllium disease, are discussed. Acute chemical pneumonitis is dose related and produced by exposure to gists, fumes and/or dust of soluble beryllium compounds. Recovery is usually spontaneous after removal from the contaminated atmosphere. The pathogenesis of chronic beryllium disease is still unknown. The fact that only a small percentage of the persons exposed develop the disease lends support to the hypothesis that there is an immunological abnormality associated with the disease, or that the susceptibility is in some way related to an inborn error of metabolism. The lung is the primary target organ of chronic beryllium disease; there is a latent period between exposure and the appearance of the disease which varies from months to as long as years. The total exposed population is unknown, but the Beryllium Registry shows over 400 cases of chronic beryllium disease from industrial and approximately 60 cases from non-industrial exposure. A relationship exists between the thermal history of beryllium oxide and its toxicity; the oxide calcined at 1150 C was virtually non-toxic, whereas material calcined at 1100 C and 800 C caused a progressive increase in mortality with decreasing calcining temperature. With respect to particle size, crystallinity, and density, the physical-chemical properties produced from rocket motor test firings are strikingly similar to the oxide formed by calcining at 1600 C. The need for analytical methods capable of differentiating between soluble and insoluble beryllium compounds and identifying individual insoluble compounds was brought out. Continuation of the existing limit of 0.01 micrograms/sq m averaged over 30 days for continuous exposure was recommended. A series of air quality criteria for intermittent exposure to soluble beryllium compounds and to beryllium oxide were recommended.

3372 APTIC NUMBER 20687

Linch, Adrian L., Emil G. Wiest, and Morris D. Carter
EVALUATION OF TETRAALKYL LEAD EXPOSURE BY PERSONNEL MONITOR SURVEYS. Am. Ind. Hyg. Assoc. J., 31(2):170-179, March-April 1970. 9 refs.

Coincident with a review of the Threshold Limit Values (TLV's) for tetraalkyl lead and the incorporation of TLV's into state regulations, an evaluation of the lead exposure control program was made. Fixed station atmospheric sampling in the tetraethyl lead (TEL) and tetramethyl lead (TML) manufacturing areas did not correlate well with urinary excretion rates c routine medical examinations of personnel. Personnel monitori g with individually worn mobile samplers was studied as a means of obtaining valid evaluation of the highly variable ambient work atmosphere. The results did not correlate with fixed-station sampling, but did give significantly higher concentrations. An approximately linear relationship was found between breathing zone concentrations and urinary excretion of lead when the sum of weekly average organic and inorganic TLV coefficients was compared with the corresponding average urinary excretion. The 1967 TLV's for TEL and TML were exceeded by factors of two and four, respectively, before urinary lead excretion exceeded 0.1 mg/l. (Author abstract modified)

3373 APTIC NUMBER 20700

Lindall, Arnold W.
EFFECT OF AIR POLLUTION FROM FOSSIL FUEL COMBUSTION ON HUMAN HEALTH. Minn. Med., 53(3):321-326, March 1970. 24 refs.

The effects of air pollution on human health are discussed. A significant correlation was found between local deaths due to bronchitis in England and the pH of rain in an area that was in a direct wind line from the industrial centers. In another study, pneumonia mortality correlated strongly with atmosphere sulfate deposition. In an epidemiological study, sulfur dioxide was consistently correlated with relevant disease. When the disease rate for various categories was analyzed for days of the low 1/3 of SO2 concentration and for days of the high 1/3 SO2 concentration, infectious disease, acute respiratory infection, and bronchitis showed the greatest increase on high SO2 days. In another study, lower respiratory infections in children were related to air pollution, while upper respiratory diseases were not. Cigarette smoking causes a primary effect on the bronchioles, leading to impaired defense against infection. With continued exposure, panlobular emphysema ultimately results. National studies are recommended to place the morbidity rate from pollution in quantitative terms so that the relative pollution dangers can be assessed. Some of the elements of pollution include the following: carbon dioxide, of little immediate health significance; carbon monoxide, reaching high levels in traffic; nitric oxide and nitrogen dioxide, both found in urban air of which NO2 is highly toxic; peroxyacetyl nitrate; and ozone, which causes changes in lungs at low concentrations.

3374 APTIC NUMBER 20475

Mallet, L. and M. Heros
RESEARCH ON THE FIXATION OF POLYBENZENE HYDROCARBONS OF THE 3,4-BENZOPYRENE TYPE BY MICROORGANISMS AND THEIR ROLES AS VECTORS OF CANCEROGENIC SUBSTANCES. (Recherches sur la fixation des hydrocarbures polybenzeniques du type benzo-3,4 pyrene par les micro-organismes et leur roles comme vecteur des substances cancerogenes). Text in French. Compt. Rend., 253(3):587-589. July 17, 1961.

Investigations of transmitters of carcinogenic hydrocarbons to the innermost part of human tissue were carried out. It is suggested that in certain cases, microorganisms can support such substances; alcohol-acid resistant bacteria in particular retain 3,4-benzopyrene because of their waxy constitution. Other microorganisms having a special affinity for 3,4-benzopyrene may also play a role in transporting such substances. (Author abstract modified)

3375 APTIC NUMBER 20521

Mazelov, A. M.
THE VITAMIN C AND B1 LEVELS IN THE BODIES OF ADOLESCENTS EXPOSED TO THE ACTION OF HYDROCARBONS. (Sostoyanie C i B1 vitaminnoi obespechennosti organizma podrostkov, podvergayushchikhsya vozdeistviyu uglevodorodov). Hyg. Sanit., 29(3):46-51, March 1964. 15 refs.

Studies were conducted on a group of adolescents undergoing occupational training in an oil-refinery installation to determine the influence of low hydrocarbon concentrations on the vitamin C and B1 levels of the body. Quantitative vitamin analysis was accomplished by testing the urinary excretion on a fasting stomach an hour after the first urination. Thiamin content was determined by the Jansen thiochrose method, and ascorbic acid content was determined by the Jezler-Wiederberger method utilizing the Levinson and Ratner modification. Adolescents exposed to hydrocarbons excreted less vitamin C and B1 in urine than a control group; seasonal fluctuations were noted, with excretion of these vitamins lower in spring than in winter. Accumulated data from these studies revealed that the effects of low hydrocarbon concentrations on the vitamin C and B1 levels of the body are reversible. Thus it is possible to reduce the toxic effects of the hydrocarbons by the additon of vitamin supplements to the students' diets. This supplement increases the body's resistance to the unfavorable effects of the hydrocarbons.

3376 APTIC NUMBER 21814

Miyachi, Kazuma and Hideo Washiwani
AIR POLLUTION AND RESPIRATORY DISEASE OF YAMAICHI DISTRICT: THE TYPE OF YOKKAICHI ASTHMA. (Yokkaichi chiiki ni okeru taikiosen to kokyuki shikkan: iwayuru Yokkaichizensoku no byokei ni tsuite). Text in Japanese. Sangyo Igaku Kenkyusho Gyosekishu (Report Inst. Ind. Med.), no. 3:69-80, June 1, 1969. 25 refs.

The relationship between the Yokkaichi type of asthma and Yokkaichi air pollution, of which the major constituent is sulfur dioxide from petrochemical plants, are discussed, together with characteristics of the pollution and its effects on respiratory organs. It has been widely accepted that lung emphysema develops primarily from simple chronic bronchitis. This theory is contradicted by a Yokkaichi study which grouped patients with respiratory disease into those (group A) who had the disease before the construction of the petrochemical plants and those (group B) who did not develop it until after the plants were in operation. Group A had a higher incidence of lung emphysema than group B, which tended more toward non specific bronchial asthma. The findings are accounted to the difference in the length of exposure to polluted environment by sulfurous acid gas from the plants, namely, non specific bronchial asthma in group A developed into lung emphysema after more than eight years of exposure. The fact that more bronchial asthma was found in group B underlines the high probability of the group passing through the same process as group A. This type of process is construed to be distinctively representative of the effect of Yokkaichi air pollution. It is concluded that chronic bronchitis is not predominantly responsible for lung emphysema where Yokkachi type air pollution exists.

3377 APTIC NUMBER 21087

Mosendz, S. A. and A. I. Silakova
EFFECT OF MANGANOUS CHLORIDE ON NITROGEN METABOLISM. (Vliyaniye khloristogo margantsa na azotistyy obmen). Vopr. Med. Khim., vol. 14:27-31, Jan.-Feb. 1968. 16 refs. Translated from Russian. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 10p., 1969.

The effect of manganous chloride on nitrogen metabolism in rats weighing 200-220 grams was studied. A 10% solution of manganous chloride was administered endotracheally in doses of 20 mg manganese per rat. The animals were decapitated on the 1st, 6th, and 30th day after poisoning. Members of the control group were also killed at the same time. The tissue studied was rapidly removed, frozen in liquid air, and carefully pulverized. The frozen pulverized tissue was suspended and stirred in 5% trichloroacetic acid. Proteins were separated by centrifugation. Intoxication, brought about by single endotracheal administration to rats of 10% manganous chloride solution in doses corresponding to 15 mg of manganese per rat was accompanied by an increase in ammonia content in the blood, brain, liver, and skeletal muscles on the 1st and especially on the 6th day after administration. On the 30th day, the ammonia content in the blood was close to its content in normal animals; in the brain, liver, and skeletal muscles, it remained at a high level. Together with the increase in ammonia content in tissues, there was an intensification of processes directed toward the elimination of its toxic action: an increase in content of free glutamine and of protein amide nitrogen. The most pronounced changes in ammonia metabolism occurred in liver tissue and were somewhat less in brain tissue.

3378 APTIC NUMBER 20502

Moulton, David G.
NASAL RESPONSES TO CHEMICAL STIMULATION. (FINAL REPORT). Pennsylvania Univ., Philadelphia, Monell Chemical Senses Center, Grant DAHC 19-68-G-0026, Rept. 1, 18p., Sept. 1969. 2 refs.
CSPTI, DDC: AD 696138

The properties of the nasal trigeminal and olfactory systems were explored in rat and man using electrophysiological, anatomical, and behavioral techniques. Rat trigeminal sensitivity was greater, electrophysiologically, than olfactory sensitivity for pyridine and butyric acid but less than amyl acetate. A new apparatus for measuring sensitivity of rats to test odorants was constructed and appropriate test procedures were developed. A human anosmic subject could detect only hydrochloric acid, acetic acid, pyridine, formic acid, butyric acid, ethyl ether, and ammonia from a range of odorous compounds presented, while discrimination between different detectable stimuli appeared to be possible only if intensity differences were also present. Eight rats, showing average performance on the detection of cyclo-pentanone and meta-xylene, were trained on a ketone, and only six of the rats achieved scores significantly above chance; seven of these rats were examined electrophysiologically, and units in the olfactory bulb sensitive to amyl acetate were identified. A much smaller proportion responded to the steroid

and ketone. Fifteen rats were divided into one group which was adapted to meta-xylene, then tested behaviorally to determine sensitivity to cyclopentanone, and a record group for which the opposite procedure was used. Both groups showed cross-adaptation, but the cross adapting effect of meta-xylene on response to cyclopentanone was larger than the cross-adapting effect of cyclopentanone on meta-xylene.

3379 APTIC NUMBER 21075

Nagorova, E. P.
ATMOSPHERIC AIR DUSTINESS OF KALININ AND CITY STREET EYE TRAUMATISM. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:214-215, 1963. (P. S. Levine, ed.) CFSTI: 63-11570

The effect of industrial discharges on the atmospheric air dust density of Kalinin city and the correlation between dust density and the occurrence of street eye trauma was studied. A total of 289 samples were collected by the sedimentation method and 108 samples by the aspiration method at 6 selected city points. Averages of annual dust sedimentation ranged between 349.7 and 541.5 g/sq m. The rate of dust sedimentation in the industrial region was 14 times as high as in the center of the city. Results of the aspiration method showed that dust density in the air of the city center exceeded the limit of allowed concentration by 3 times and in the air of the industrial region, by a range of 11-30. During the cold months, when heating furnaces were in operation, the dust concentrations were twice as high as during the warm seasons of the year. Street eye traumas constituted 9.6% of the total eye diseases in the residential part of the city and up to 29.3% in the industrial section. In the 58.8% of the cases, eye traumas were caused by coal particles and flyash. Eye traumas caused by sand particles constituted 11.1% of the total eye damage. It was concluded that there is a direct correlation between the intensity of air dust density and the frequency of street eye trauma. It was recommended that all industrial plants which contributed to the city air dust and flyash density be equipped with high efficiency dust catching devices.

3380 APTIC NUMBER 20515

Mazzaro, James P., Donald E. Jackson, and Lloyd E. Perkins
EFFECTS OF IONIZED AIR ON STRESS BEHAVIOR. Med. Res. Eng., 6(3):25-28, Third Quart. 1967. 11 refs.

The differential effect of negative and positive ions on a conditioned emotional response in 6 white rats was based on the hypothesis that exposure to negative ions parallels the action of reserpine. A standard Foringer-made Skinner box with a grid floor was used, employing lever-pressing for water reward, and the cages were constructed so that ion adsorption would be minimal; the ions were generated by radio-active beta emitters using 50 millicuries of tritium gas sealed in zirconium on stainless steel. Following a 5 day control period, half the animals were subjected to positive and half to negative ions; after 8 days, the conditions were reversed. Results suggest that negative ions, like reserpine, reduce anxiety but facilitate learning, whereas positive ions may increase anxiety but interfere with learning. When comparisons were made between control and negative conditions, animals 1, 3, and 5 did show significant increases, but a reverse effect was demonstrated by animals 8 and 9 which responded to positive ions. The exact mechanism by which ions produce behavioral changes is not clear, but its relation to 5-hydroxytryptamine offers some promising new areas of investigation. (Author abstract modified)

3381 APTIC NUMBER 21377

Nelson, Norton
RESEARCH IN ENVIRONMENTAL HEALTH SCIENCES. New York Univ., N. Y., Inst. of Environmental Medicine, NIH Grant Es-00260, 155p., Dec. 31, 1969. 206 refs.

The research effort of the Institute of Environmental Medicine is broadly aimed at assessing known or potential damage to man by environmental agents, and in terms of time and effort, the study of carcinogenicity of environmental agents is the largest single portion of the program. Because inhalation is one of the major routes of entry, there is a concern with the fate of these agents in the respiratory tract, and investigations include deposition, clearance, and biological effects of a variety of inhaled materials. An extensive program on the biological effects of ionizing radiation includes work on man and animals exposed to high levels of natural background radiation as well as occupational exposure. Through an initial interest in the distribution of radionuclides in the Hudson River, a program was developed to study the ecology of the lower Hudson River. Statistical and mathematical aspects of problems in environmental health are being studied in terms of idealized prototype situations, and a variety of toxicological responses are being investigated. Graduate programs for research, teaching, and practice in several fields of environmental health are offered by the Institute.

3382 APTIC NUMBER 21113

Neville, G. A.
TOXICITY OF MERCURY VAPOR. Can. Chem. Educ., 3(1):4-7, Oct. 1967. 33 refs.

Threshold limit values have been set at 0.1 milligram/cu m for mercury vapor in the atmosphere and at 0.01 milligram/cu m for mercury organic compounds. Access to the body is gained mainly through the respiratory tract, but absorption may be also through the skin or by ingestion. A study of the metabolism of inhaled vapor in the rat indicated that after exposures of 5 hours to an Hg level of 1.4 milligrams/cu m, the metal was generally distributed in the body, becoming highly localized in the kidney with an accumulation after 15 days of 70% or more of the body burden. Mercury inhibits urease, invertase, and other enzymes

carrying sulphhydryl groups; produces potassium ion loss; blocks glucose uptake by erythrocytes and muscle; causes lesions of the central nervous system; and influences bioelectric phenomenon by altering transmembrane potentials and by blocking nerve conduction. The most frequent manifestations of chronic poisoning are gingivitis and stomatitis, tremor, and erethism, while death usually results from acute cases. Mercury spillages are most conveniently cleaned up with a filter flask, the side arm of which is linked by tubing to a water aspirator. The importance of thorough washing of the hands must be emphasized.

3383 APTIC NUMBER 20739

Novelli, A., U. M. Marinari, L. Santi, D. Cottalasso, and L. Ferreri
MORPHOLOGICAL AND HISTOPATHOGENETIC DIFFERENCES IN SILICOTIC GRANULOMATA INDUCED IN THE LUNGS OF RATS BY TRIDYMITE AND CRISTOBALITE. (Differenze morfologiche e istopatogenetiche nei granulomi silicotici polmonari indotti nel ratto dalla tridimite e dalla cristobalite). Text in Italian. Pathologica, 61(895/896):79-110, March-April 1969. 69 refs.

Wistar rats with an average body weight of 150 g at the beginning of the experiment were fed in lots of 400 animals tridymite and cristobalite ground to a special grain size. Each animal received 50 mg of powder suspended in 1.5 ml of physiological solution, after which the rats were fed with a liquid diet for several days. The animals were sacrificed 2 at a time, every 10 days, beginning with the day of treatment. After 2 months they were sacrificed once a month until the fifteenth month. It was concluded from the results obtained that the phlogistic reactions differed appreciably, according to the type of powder used (tridymite or cristobalite); tridymite caused a more severe form of silicosis, causing a very rapid formation of granulomata with a high degree of fibrosis in just 2-3 months; the cristobalite more frequently caused a histiocytic reaction, with the formation of epithelioid cells, with maximum fibrosis occurring only after 6 months; both types of granulomata (but most frequently cristobalite) contained heavy crystalline deposits of cholesterol; animals treated with tridymite had more intense reactions, involving the macrophages and plasma cells and earlier degranulation of mast cells; tridymite cases more frequently exhibited a filtration of eosinophil leukocytes into the granulomata. It would seem that these eosinophil leukocytes participate in silicosis due to the liberation of a mastocytolytic principle during phagocytosis of the immune complexes. Differences in the behavior of tridymite and cristobalite silicoses could be attributed to differences in the crystal lattice, to granulomatric differences in the powders used, to impurities in the materials, or even a difference in the reactivity of the strains of rats used.

3384 APTIC NUMBER 20704

Orton, W. T.
LEAD POISONING AMONG CHILDREN IN HARINGEY. Medical Officer, 123(12):187-192, March 20, 1970. 10 refs.

Four case reports of lead poisoning among five children are discussed. The ages of the children ranged from 22 months to 11 years. All suffered from pica. The clinical histories and the investigations conducted to determine the origin of the lead are described. The results showed the diversity of causes of lead poisoning in children. Modern paints with low lead content gave only apparent protection if applied over old paints containing high quantities of lead. There was evidence suggesting that wall plaster could be a cause of poisoning. The very high concentrations of lead found over a wide area demonstrate a potentially dangerous source of lead to any child who eats soil. It is believed that the contamination came from a number of sources: dust from a battery factory; automobile exhausts; and old split paint in builders' rubble. There is added danger, with respect to vegetables grown in the soil. Automobile exhaust fumes, particularly where the traffic is most dense raise the lead content of the dust and earth nearby; they can also affect rainwater. Contamination from all these sources can build up and ultimately reach toxic levels.

3385 APTIC NUMBER 21301

Paulet, P. and S. Desbrousses
ACTION OF CHLORINE DIOXIDE (ClO2) IN WEAK CONCENTRATIONS ON LABORATORY ANIMALS. (De l'action du bioxyde de chlore (ClO2) a faible concentration sur les animaux de laboratoire). Text in French. Arch. Maladies Profess. Med. Trav. Securite Sociale (Paris), 31(3):97-106, March 1970. 5 refs. (Presented at the Societe de Medicine et d'Hygiene du Travail, July 10, 1969.)

The effect of air containing chlorine dioxide was determined in concentrations between 0.1 and 10 ppm on laboratory rats and rabbits. The ClO2 was produced by the action of an acid on sodium chlorite, dissolved in water and picked up by the passage of an air current over this solution. The ClO2-bearing air was passed through a chamber made of plexiglass, permitting visual observation of the test animals placed in it. A control group was placed in another chamber in which was free of ClO2. Tests were run with air comprising 10 ppm of ClO2 for 2 hours per day for 30 days; 5 ppm of ClO2 for 2 hours per day for 30 days; 2.5 ppm of ClO2 for 7 hours per day for 30 days; and 2.5 ppm of ClO2 for 4 hours per day for 45 days. Measurements were made of the weight of the animals, red blood-corpuscle count, white blood-corpuscle count, and blood composition before and after total exposure time. Graphs are plotted of weight versus time for the test and control animals. All measured data are given in tablets and briefly discussed. In air with more than 40 ppm of ClO2, death occurs by severe edema of the lungs after a brief exposure; with more than 15 ppm of ClO2 death may occur due to acute bronchopneumonia; with 2.5 to 10 ppm of ClO2, bronchial and alveolar lesions arise which are rather rapidly reversible and whose severity varies directly with the ClO2 content. The lower limit of bronchopulmonary attack appears to be 2.5 ppm of ClO2 for rats and rabbits. In shops in which ClO2 is used as a bleaching agent, its content in air is less than 0.1 ppm. Hence there is a large margin of safety.

3386 APTIC NUMBER 21482

Petr, B. and P. Schmidt
THE EFFECT OF SULPHUR DIOXIDE AND NITROUS GASES POLLUTED ATMOSPHERE ON THE ORGANISM. (Vliv ovzdusi znecisteneho kyslicnikem siricity a nitroznimi plyny na organismus). Text in Czech. Cesk. Hyg. (Prague), 11(4):210-220, 1966. 18 refs.

Chronic exposure to atmospheres polluted with sulfur dioxide and nitrogen oxides causes significant effects on children's health. The effects are more profound when these pollutants are present in a ratio approaching one, than in an atmosphere where SO2 predominates. When nitrogen oxides are predominant, the two pollutants acting simultaneously create a synergistic effect. When the concentration of SO2 is significantly higher than that of nitrogen oxides, the two acting together tend to cancel out each other's effects. To prevent health impairment, concentrations should be eliminated or reduced to levels below maximum admissible concentrations; until these measures can be carried out, arrangements should be provided for children to spend greater periods of time in unpolluted areas. (Author summary modified)

3387 APTIC NUMBER 21458

Prendergast, J. A., R. A. Jones, L. J. Jenkins, Jr., and J. Siegel
EFFECTS ON EXPERIMENTAL ANIMALS OF LONG-TERM INHALATION OF TRICHLOROETHYLENE, CARBON TETRACHLORIDE, 1,1,1-TRICHLOROETHANE, DICHLORODIFLUOROMETHANE, AND 1,1-DICHLOROETHYLENE. Toxicol. Appl. Pharmacol., vol. 10:270-289, 1967. 21 refs.

Rats, guinea pigs, dogs, rabbits, and monkeys were exposed to trichloroethylene, carbon tetrachloride, 1,1,1-trichloroethane, dichlorodifluoromethene, and 1, 1-dichloroethylene. Continuous 90-day exposures were conducted, as well as 8-hour exposures, 5 days a week, for a total of 30 exposures. Visible signs of toxicity and hematologic, biochemical, pathologic, and body weight changes were studied. No visible signs of toxicity were noted in any species. However, significant mortality was found in the repeated and continuous exposures to carbon tetrachloride. and in the continuous exposures to 1,1-dichloroethylene at 189, 101, and 61 mg/cu m. Growth depression was found in all continuous exposures to trichloroethylene carbon tetrachloride, and 1,1-dichloroethylene, as well as in the repeated exposures to carbon tetrachloride. No significant hematologic alterations were noted in any of the studies. Serum urea nitrogen levels were within control limits in all exposures to carbon tetrachloride, 1,1-dichloroethylene, and 1,1,1-trichloroethane. Liver lipid contents in guinea pigs were found to be elevated after repeated exposure to 515 mg/cu m of carbon tetrachloride. Elevations of serum glutamic-pyruvic transaminase and liver alkaline phosphatase activities were found in rats and guinea pigs after continuous exposure to 189 mg/cu m of 1,1-dichloroethylene. Histopathologic study revealed liver damage after continuous exposure to high levels of dichlorodifluoromethane, and to lower levels of carbon tetrachloride and 1,1-dichloroethylene. (Author summary modified)

3388 APTIC NUMBER 20403

Purvis, M. P. and R. Ehrlich
EFFECTS OF ATMOSPHERIC POLLUTANTS ON RESISTANCE TO RESPIRATORY INFECTIONS. Armour Research Foundation, Chicago, Ill., Contract SAph 73297, APP Proj. C 161, Rept. APP 3161-5, 27p., May 23, 1962.

Male and female Swiss albino mice of the Webster strain, 10 to 12 weeks old and weighing 28 to 34 g, were exposed to 25, 15, 10, 5, and 2.5 ppm nitrogen dioxide in air. The effect of NO2 on the resistance of these mice to respiratory infection caused by Klebsiella pneumoniae was studied. The experimental methods were described in earlier reports. Statistically significant increases in mortality rates as well as decreases in survival time were obtained when the mice were exposed to the NO2 concentrations for 2 hours less than 27 hours prior to challenge with the aerosol. Likewise, mortality increased and survival time decreased significantly when mice were exposed for 10 hours to 5 ppm of NO2 less than 27 hours prior to aerosol challenge. When the infectious aerosol challenge preceded the 2-hour exposure to 25 ppm of NO2 by 1,6,27,48, and 72 hours, the experimental mice showed a mortality significantly greater than the controls. No significant mortality difference between control and experimental mice occurred at a 2-hour exposure to 2.5 ppm NO2 and challenge with infectious aerosol 1,6,and 27 hours prior to and following the exposure. Limited hematological studies were carried out after exposure of mice to 2.5 ppm of NO2 for a 2-hour period. The data indicate a possible decrease in hematocrit and hemoglobin values, and the lymphocyte-to-neutrophile ratio shifted in favor of the neutrophile when the mice were sacrificed 1 hour after NO2 exposure as compared with normal mice and mice sacrificed 27 hours after NO2 exposure. Damages of the lung tissue occurred which decreased with decreasing NO2 concentration.

3389 APTIC NUMBER 21266

Reichel, G., F. Wobith, and W. T. Ulmer
ACUTE AND CHRONIC EFFECTS OF AIR POLLUTION PRODUCED BY TRAFFIC AT A BUSY CROSSING ON LUNG FUNCTION IN HUMANS. DETERMINATION OF CO, HB, PB, IN BLOOD. (Akute and chronische Wirkung von Strassenluft an verkehrsreicher Kreuzung auf die Lungenfunktion des Menschen, Den CO-, Hb-, und Bleigehalt des Blutes). Text in German. Arbeitsmedizin, 26(1):88-97, 1970. 73 refs.

To determine the effects of exposure to street traffic on lung function restrictions, 44 persons were subjected to a blood-gas analysis and whole-body plethysmographic examination before and after an exposure of three hours at a busy crossing. The carbon monoxide and lead levels were also determined. No insufficiencies or functional restrictions of the lungs were verified as a result of acute exposure. These findings were also confirmed when examining 10 policemen permanently exposed to the air pollution of a large city. A suspicious saturation of the blood with CO could not be verified. In smokers, a decrease in the CO-level during the testing period, when no smoking was allowed, was observed. The increase of the blood-lead-level needs further investigation. Even if the lead level after exposure does not exceed the toxic limit value, the problem of gasoline lead additives needs further attention.

3390 APTIC NUMBER 20619

Schroeder, Henry A.
CADMIUM, CHROMIUM, AND CARDIOVASCULAR DISEASE. Circulation, vol. 35:570-582, March 1967. 64 refs. (Presented at the Thirty-ninth Scientific Sessions of the American Heart Association, New York, Oct. 22, 1966.)

Observations made in the last 15 years on the effect of cadmium and chromium on animals and man are reviewed with special reference to hypertension and atherosclerosis. Several thousand rats and mice raised in an environment as metal-free as possible had little or no detectable cadmium in their tissues, indicating that cadmium is probably not an essential micronutrient for these mammals. When the rats were given traces of cadmium (5 micrograms/ml) in drinking water from the time of weaning, hypertension began to appear after about a year, and increased in incidence with age. Once hypertensive, the animals remained so until death. The incidence of hypertension was greater in females than in males, but the mortality among males with hypertension was greater than among females. Removal of some of the cadmium, resulting in a return to normotension, was effected by the use of a zinc chelate. The renal ratios of cadmium and zinc correlated reasonably well with blood pressure level. There is good correlation with deaths from hypertensive heart disease and softness of municipal water supplies. Though air is a minor source of cadmium, a correlation also exists between cardiovascular death rates and the amount of cadmium present in the air as an industrial pollutant. No significant correlations have been found between cardiovascular death rates and chromium in municipal water. The most significant association is between atherosclerosis and the degree of softness of the water, which may reflect the uptake of cadmium from pipes. Atherosclerotic heart disease often has a hypertensive component, which may explain this association.

3391 APTIC NUMBER 20664

Shamilov, T. A.
TOXICITY CHARACTERISTICS AND HAZARDS OF BROMOBENZENE. (Kharakteristika toksichnosti i opasnosti brombenzol). Text in Russian. Gigiena Truda i Prof. Zabolevaniya, no. 9:56-58, 1969.

Toxicities for bromobenzene were established as follows (LD50): gastrointestinally in rat, 3200 mg/kg; gastrointestinally in mouse, 2700 mg/kg; 4-hr inhalation in rat, 42 mg/liter; and 2-hr inhalation in mouse, 21 mg/liter. The clinical picture of intoxication was similar in all cases (sluggishness, adynamia, and loss of response to surroundings after 1.5-2 hr; death in 1-3 days). Chronic studies were also made with 108 male rats and 12 rabbits to establish threshold effects. Changes in SH-group content in blood serum and liver homogenate are reported for chronic 4-hr per day, 6-day per week inhalation at concentrations of 0.12 and 0.003 mg/liter for periods of 1.5, 3, and 4.5 months. Threshold concentration for bromobenzene was established at 0.02 plus or minus 0.005% mg/liter, and a maximum permissible concentration of 3 mg/cu m was recommended and enacted.

3392 APTIC NUMBER 12293

Sheftel', V. O., G. M. Rozhko, A. I. Kuz'mina, L. A. Shkvar, T. L. Ovdienko, and I. D. Fainzil'ber
DETRIMENTAL EFFECT OF VOLATILES RELEASED BY INDENE-COUMARONE RESIN AT 20 AND 40 C. (Vrednoe deistvie letuchikh veshechestv, vydelyaemykh inden-kumaronovoi smoloi pri 20 i 40 C). Hyg. Sanit., 33(7-9):116-118, July-Sept. 1968. 3 refs.

The resin indene-coumarone, widely used in building materials, was studied to determine any harmful effects of volatiles it releases at 20-40 C, the ambient temperature of dwellings. Rats were places in a chamber simulating natural environmental conditions. No detrimental effects were found at 20 C; at 40 deg, exposure to substances released by the resin caused a statistically significant prolongation of the latent period of the condition reflex to a sound stimulus; the exposed group of rats had a considerably higher percentage of disturbances in the conditioned reflexes in general than the control group. No significant histologic or hematologic changes were detected.

3393 APTIC NUMBER 21074

Sorokina, S. P.
A STUDY OF CARBON MONOXIDE CONCENTRATIONS IN THE AIR OF LIVING DWELLINGS AND ITS EFFECT ON THE ORGANISM. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:207-213, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

The carbon monoxide concentrations in the air of living premises in Leningrad and its effects on the health of the occupants were investigated. Eight hundred and ninety five air samples were collected by the foot-ball method in the center of each apartment, 1.5 m above the floor, under normal gas burning conditions. Carbon monoxide concentrations were determined by the conductometric method. Results showed that the air was considerably polluted with CO primarily coming from gas burning heaters and stoves. Carbon monoxide concentrations in the indoor air at all seasons of the year exceeded the maximal allowable CO concentrations by 1.5-35.5. Concentrations of CO and per cent of relative humidity were greater in the air of residences equipped with individual gas heaters than in the air of centrally gas heated apartments. Sixty five of 80 interrogated occupants of gas equipped apartments complained of headaches, chest pain, vertigo, nausea, vomiting, general debility, and rapid fatigability. Occupant housewives had an average hemoglobin of 77-80%, as against the normal 70-71%, and their erythrocyte counts were also higher. Blood carboxyhemoglobin was above 9% in 62% of the investigated persons, with an average of 9.5-10.0%. About 33.5% of the housewives manifested symptoms of hypotonia and hypothermy. General chronaxy was delayed as compared to the controls. Subjective complaints, blood changes, arterial blood pressure, and increase in chronaxy in chronic exposure to the inhalation of CO can not be accounted for an anoxy alone. The direct action of CO on tissues and cells of organisms must also be taken into account. It was concluded that the use of shale gas for domestic purposes can result in chronic intoxication.

3394 APTIC NUMBER 20398

Spinelli, P. and H. Herzog
NEW METHOD FOR MEASURING AND EVALUATING THE BLOOD FLOW THROUGH LUNG CAPILLARIES BY THE LAUGHING-GAS METHOD. (Neues Verfahren fuer die Messungund Beurteilung der Lungencapillardurchblutung nach der Lachgasmethode). Text in German. Klin. Wochschr., 45(15):759-763, Aug. 1967. 19 refs.

A method for determining the pulmonary capillary blood flow with the air of nitrogen dioxide retention in the lungs is described which, in contrast with previously described methods of investigation in a total-body plethysmograph, is suited for use in the course of physical exercises and changes of posture of the patients. It has the additional advantage over Wasserman's 'rigid-thorax method' in that, instead of measuring a decrease of volume, it measures changes of rates of flow. The method yields reproducible values of the capillary heart- stroke volume as well as of the heart- minute volume as the proportionality of these values to the concomitant oxygen consumption demonstrates. The computation of these two volume rates from measured data is briefly described. The same method is used to demonstrate the pulsed blood flow through the pulmonary capillaries in the course of physical exercises of the patient. The peak flow at the end of the T-wave of the electrocardiogram at rest is found earlier in the cardiac cycle during physical exercise.

3395 APTIC NUMBER 20972

Starodubova, T. F.
MANGANESE BALANCE IN PUPILS OF A BOARDING SCHOOL UNDER CONDITIONS OF THE PROCESS OF LEARNING AND A SUMMER REST IN A PIONEER CAMP. (Balans margentsa u uchashchikhsya shkoly-internata v usloviyakh uchebnoga protesessa i letnepo otdykha v pionerskom lapere). Vopr. Pitaniya, vol. 27:36-40, July-Aug. 1968. 3 refs. Translated from Russian. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 8p., Sept. 23, 1969.

Manganese balance was studied under conditions prevalent in the steppe area of the Ukraine in five groups of adolescents during the regular process of learning, during examinations, and during summer vacation. Manganese in food rations and excreta was titrated by the persulfate method. The manganese balance was found to be extremely variable, being influenced by individual peculiarities of manganese exchange and sexual differences. But the main factor determining manganese balance was the type of activities pursued by the adolescents. Under regular conditions of learning, the manganese balance in both sexes was positive. During the period of examinations, the level of manganese discharged from the body increased sharply. However, it remained positive in girls who had received high amounts of manganese in their food ration. With boys who had received less manganese in their food, a negative balance was observed. The period of summer rest was characterized by a high level of manganese discharge and a relatively low retention level compared to the regular learning process. It is concluded that adolescents should receive not less than 0.17 to 0.20 mg per day. Based on the average weight of adolescents, the diet of boarding schools in the Ukraine should contain no less than 8.5 to 10.0 mg of manganese.

3396 APTIC NUMBER 21094

Stolwijk, J. A. J., H. Graichen, and A. Bouhuys
ON-LINE PARAMETRIC FUNCTION DISPLAY. J. Appl. Physiol., 24(5): 715-716, May 1968. 4 refs.

A solid-state pulse-generating circuit which modulates the Z axis of an XY oscilloscope to plot a Y variable as a function of an X variable, with a third variable as the parameter, is useful in studying the relations between lung inflation, esophageal pressure, and airflow rate in man. Isovolume pressure-flow curves can be obtained with the X variable as esophageal pressure, the Y variable as airflow rate, and lung inflation as the parameter. During on-line processing, the point of maximum inspiration should be adjusted to a fixed setting on the direct-writing recorder for esophageal pressure-airflow rate data to yield constant lung inflation. Greater economy of time and data can be obtained when the data are first recorded on magnetic tape; by using the gate circuit during playback, one can scan all data successively for isovolume pressure-flow points at different lung inflation levels.

3397 APTIC NUMBER 21692

Stromme, Olf
POLLEN ALLERGY. (Pollenallergi). Text in Norwegian. Tidsskr. Norske Laegeforen., 90(6):607-610, 1970. 1 ref.

Various aspects of allergies caused by plant pollens are reviewed, including their cause, treatment, and prevention. In April-June, the predominant allergenic pollen is produced by trees, especially amentaceous trees; from July to August, possibly September, grass pollens are the main offenders. Symptoms occurring in early April and in September-October are usually caused by the spores of fungi. The isolation of allergenic compounds from pollen is complicated by the existance of their large variety and the probable existance of several allergenic compounds in a given pollen. Hayfever symptoms most frequently begin the year before a child starts to school, or during the next two decades, usually increasing in intensity over the years and over the duration of the hayfever season. Diagnosis and treatment of pollen-sensitive patients are discussed in detail.

3398 APTIC NUMBER 20733

Suzuki, Yasunosuke and Jacob Churg
FORMATION OF THE ASBESTOS BODY. A COMPARATIVE STUDY WITH THREE TYPES OF ASBESTOS. Environ. Pes., vol. 3:107-118, March 1969. 41 refs.

Asbestos bodies were produced experimentally in the lungs of hamsters by intratracheal instillation of three types of asbestos: soft chrysotile, harsh chrysotile, and amosite. Five animals each received a single dose of 1 mg of soft chrysotile suspended in 0.1 ml of normal saline and were sacrificed 6, 12, and 24 months later. One hamster was given a single dose of 1.5 mg of harsh chrysotile in saline suspension and sacrificed 12 months later. One hamster received monthly instillations of 2.5 mg of amosite for

a total of 25 mg. It was sacrificed 10 months after the last dose. Three hamsters were used as controls. Though the number of animals was small, each was carefully studied by examining a large number of blocks from various parts of the lungs. Though some differences were noted, harsh chrysotile and amosite fibers were converted into asbestos bodies by the same successive steps that were previously described for soft chrysotile: (1) phagocytosis of asbestos by alveolar macrophages and other phagocytic cells and incorporation into phagolysosomes; (2) accumulation of iron micelles around the fibers, possibly by fusion of asbestos-containing phagosomes with hemosiderin granules; and (3) compaction of the micelles and clearing of the peripheral zone to form a mature asbestos body. Formation of asbestos bodies seems to be a continuous process with old bodies growing in thickness and uncoated fibers being converted into bodies months or years after instillation of asbestos. Possible origins of hemosiderin are discussed. Striking hyperplasia of cell organelles was found, presumably indicative of their participation in the development of the asbestos bodies. (Author abstract modified)

3399 APTIC NUMBER 21123

Szostak, W.
THE ROLE OF MAGNESIUM IN THE BODY. (Rola magnezu w ustroju). Polski Tygod. Lekar. (Warsaw), 16(37):1421-1424, 1961. 31 refs. Translated from Polish. 15p.

Magnesium is one of the most important electrolytes in the body, averaging in adults about 25 g (about 43 mg per kg body weight). The tissues contain 98% of the entire amount, with the remaining 2% in extracellular fluids. The daily Mg requirement of the human body is about 220 mg; a normal diet fully covers this requirement. A relatively low amount of the Mg taken in is absorbed, and this only in the small intestine. About 65% of the Mg in blood plasma is totally ionized; this portion penetrates the tissues rather easily compared with the remaining protein-bound 35%. Urinary excretion is the major route of Mg elimination. Mg appears to play a major role in intracellular metabolism; the presence of Mg ions is indispensable for many enzymatic reactions. Some hormonal glands seem to affect its metabolism, although the mechanisms and controlling factors are not known. It does show a high affinity for accumulation in heart muscle. In animals, injection of Mg affects the nervous and neuro-muscular systems, resulting in depression and reduced nervous response, and with large doses, in coma. The change of Mg level in blood serum is a significant finding in certain illnesses, for example chronic alcoholism, liver cirrhosis, uremia, and diabetic acidosis. Descriptions are given of two clinical syndromes of magnesium metabolism: hypomagnesemia and hypermagnesemia. The most convincing symptom of the former is increased irritability of the neuro-muscular system, manifested by tetany attacks in severe cases.

3400 APTIC NUMBER 20543

Tada, Osamu
NITRIC OXIDE. (Sanka chisso). Text in Japanese. Rod. Kagaku (J. Sci. Labour, Tokyo), 40(5):185-191, 1964. 27 refs.

Nitrogen dioxide (NO2) is formed as the result of the oxidation of nitric oxide (NO). They frequently exist together in the atmosphere, but their mixing ratios vary, depending on the conditions under which they arise. The toxicity of NO2, the relationship between its concentration in the atmosphere, and the physiological effects, have been studied extensively, but due to the difficulties of the separative determination of NO and NO2, the earlier research materials have merely dealt with such all-inclusive entities as oxides of nitrogen, or nitrous gas containing both NO and NO2. Thus, although they are believed to produce different physiological effects when they are inhaled, their individual characteristics have rarely been examined. The subsequent discussion relating to the above includes the production and occurrence of NO, its oxidation process, as well as various methods of measuring NO and NO2. In addition, material relating to the toxicity of NO, which is relatively scarce compared to those of NO2, is examined, although there is a further problem of different physiological effects apparently occurring from various concentrations. Further investigation of NO and NO2 is necessary in connection with industrial and public health problems.

3401 APTIC NUMBER 21343

Vigdortschik, N. A., E. C. Andreeva, I. Z. Matussevitsch, M. M. Nikulina, L. M. Prumina, and V. A. Striter
THE SYMPTOMATOLOGY OF CHRONIC POISONING WITH OXIDES OF NITROGEN. J. Ind. Hyg. Toxicol., 19(9):469-473, Nov. 1937.

The symptomatology of chronic poisoning with nitrogen oxides has been investigated. The subjects were 127 men working in sulfuric acid plants and as etchers in printing shops; the period of their work with nitrogen oxides varied from three to five years. In only a few cases was the nitrogen dioxide concentration slightly above 0.005 mgm/L. Material was collected by a sanitary examination of the labor process conditions with repeated chemical analysis of the air, a morbidity study for a number of years, and a detailed clinical investigation aided by the wide use of laboratory methods. The materials collected were treated according to the rules of mathematical statistics and checked by comparison with a number of control groups. Clinical symptoms included wearing down of the teeth, enflamed gum mucosa, emphysema, tuberculosis, hypotonia, and bradycardia. Tooth decay, disturbed gastric secretion, chronic bronchitis, and cardiovascular neurosis were regarded as probable symptoms. Several morphological blood changes were also noted, such as high hemoglobin content, large numbers of erythrocytes, increased vital granulation, and marked basophile granulation. As for chemical changes in the blood, reductions were observed in the catalase index, reserve alkalinity, and sugar content.

3402 APTIC NUMBER 20518

Wettig, Klaus, Alexandra Ja. Chesina, Anna P. Linnik, Lydia W. Kriwoschejewa, and Werner-Heinz Doerre
PROBLEMS OF ADSORPTION AND DESORPTION OF 3,4-BENZOPYRENE BY SOOT IN VITRO AND IN VIVO. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(1):25-28, Jan. 1969. 8 refs.

Laboratory and animal experiments were conducted to investigate the active component in the carcinogenicity of 3,4-benzopyrene. Investigation of the adsorbing and desorbing capacity of 3,4-benzopyrene from soots using lampblack showed that these two processes depend on the quality and quantity of the soot used. The ability of soot to adsorb benzopyrene increases with increasing polarity of the solvent, which also explains the fact that the aqueous fluid of the human body can desorb only small amounts of the strongly adsorbed hydrocarbons. If this low desorbing capacity is compared with the brief retention period of small inhaled particles in the organism, it appears that at least part of the benzopyrene reaching the human respiratory tract does not become active. This is borne out by experiments where five groups of mice were administered with different combinations and concentrations of soot, lampblack, and benzopyrene. The carcinogenic activity of 3,4-benzopyrene largely depends on whether it is applied in the adsorbed or dissolved state. It seems probable from the results that a highly adsorbed 3,4-benzopyrene plays a considerably smaller role in cancer formation than a loosely bound 3,4-benzopyrene. This agrees with the predominant localization of tumors in the respiratory tract, largely in the bronchial region, which is observed clinically, since this region is reached by particles with larger diameters which adsorb benzopyrene to a lesser extent. (Author conclusion modified)

3403 APTIC NUMBER 21259

Wolfonsky, Peter Walia
PULMONARY EFFECTS OF AIR POLLUTION. Arch. Environ. Health, vol. 19:540-547, Oct. 1969. 35 refs. (Presented at the American Academy of Occupational Medicine, 21st Annual Meeting, Boston, Mass., Feb. 5, 1969.)

The pulmonary effects of a variety of air pollutants are reviewed. Interest in most particulates is due to their role as carriers of other pollutants, while known pathogenic particulates (such as the benzo(a)pyrenes or the products of tetraethyl lead combustion) are of primary interest as chemicals rather than particles. Carbon monoxide apparently has no significant direct effects on the lungs, but the question has been raised as to whether there may also be subacute or chronic effects. In experimental animals exposed to sulfur dioxide at concentrations higher than those typically observed in ambient air, SO2 acts as a primary irritant, and leads to bronchoconstriction and increased airway resistance. Alveolar and bronchiolar lesions typify exposure to nitrogen oxides. Profound and persanent changes possibly occur in lungs exposed to nitrogen dioxide, as in the acute pulmonary edema associated with silo-filler's disease. Nitrogen dioxide has been found to cause emphysematous lungs in rats. Exposure to NO2 is also believed to permit better bacterial colonization in the lungs by inhibition of bacterial clearance. Ozone may decrease the percentage of alveolar macrophages and their ability to engulf streptococci. The severity of symptoms in a group of Chicago patients with chronic bronchitis or emphysema showed seasonal fluctuations related to mean monthly temperature, with briefer exacerbations, closely correlated to low temperature and high SO2 level. The pathological and synergistic effects of air pollution are also discussed.

3404 APTIC NUMBER 21339

Won, William D. and Jerome F. Thomas
EFFECTS OF ARENE-TYPE HYDROCARBON AIR POLLUTANTS ON BACILLUS MEGATERIUM. Appl. Microbiol., 10(3):217-222, May 1962. 15 refs. (Presented at the American Society for Microbiology, 61st Annual Meeting, Chicago, Ill., April 23-27, 1961.)

Bacillus megaterium was grown in the presence of polycyclic aromatic hydrocarbons, including the noncarcinogenic phenanthrene, chrysene, and anthracene, and the carcinogenic benz(a)pyrene and 20-methylcholanthrene; and then examined for growth, intracellular reactions, and biochemical alterations. Depending on the medium used, either growth suppression or induction of a typical cell form was observed in cultures grown in the presence of a carcinogen. No such alterations were apparent in cultures grown in media supplemented with a noncarcinogen. Both carcinogenic and noncarcinogenic hydrocarbons exerted an enhancing influence of varying degree on lipogenesis, glycolysis, and methylene blue reductase activity. A higher than normal level of these reactions, however, was associated with cultures exposed to a carcinogen. Infrared examination of lipids revealed unique spectral characteristics for materials extracted from carcinogen-treated cultures. No difference was noted between materials derived from noncarcinogen-treated and control cultures. (Author abstract modified)

3405 APTIC NUMBER 21342

Wynder, Ernest L. and Dietrich Hoffman
CARCINOGENICITY OF DIBENZO(A,I)PYRENE. Nature (London), 192(4807):1092-1093, Dec. 16, 1961. 13 refs.

Dibenzo(a,i)pyrene (1,2,3,4-dibenzopyrene) has been shown to be present in cigarette smoke condensate and in automobile exhaust gas in small quantities. The results of testing the carcinogenic activity of different concentrations of the compound are tabulated. Acetone solutions in concentrations of 0.25, 0.1, 0.05, and 0.01% were applied 3 times weekly to the backs of 6-wk old Swiss female mice. (Author abstract)

3406 APTIC NUMBER 20255

Yamaliwa, H., J. Nakamura, Y. Hamazaki, S. Takeda, and Y. Sakakira
EFFECTS OF YOKKAICHI AIR POLLUTION ON THE LIVING BODY-PATHOLOGICAL STUDY OF ASTHMA AND RABBITS. (Yokkaichi taikiosen no seitai eno eiko - zensokurei to ieusagi no byorigakuteki kento). Text in Japanese. Igaku No Ayumi (Progr. Med.), 7(8):360-363, Nov. 22, 1969. 3 refs. Mie Prefectural Univ. School of Medicine (Japan).

Repeated asthmatic paroxysms were induced in rabbits, after which extensive examinations were conducted of lungs and other organs. Bronchitis was accompanied by equall amounts of minor and medium lymphocytes and the infiltration of plasma cells. Adrenal glands were remakably reduced, and cortical substances exhibited a yellowish brown pigment. The air in Yokkaichi city was composed of sulfur dioxide, sulfur trioxide, sulfuric acid mist, and nitrogen compounds. As for their effects on the respiratory system, the human upper airpassage and pharynx were affected by the frequent and direct action of the materials. The presence of chronic bronchial catarrh was observed, as was the presence of asthmatic bronchial catarrh which appears to be caused by an allergy mechanism. Some patients with chronic asthmatic spasms died from the bronchial catarrh. It is concluded that bronchial asthma is implicated when the asthmatic paroxysm occurs in a polluted area like Yokkaichi city.

3407 APTIC NUMBER 21061

Yoshida, Katsumi
CONCERNING AIR POLLUTION AND THE INFLUENCE ON HUMAN BODIES BY HARMFUL SUBSTANCES IN THE AIR. (Taikiosen to sono zintai eikyo osen busshitsu to sono hyoka ni kanrensite). Text in Japanese. Eisei Kagaku (J. Hyg. Chem.), 15(2):54-60, April 30, 1969. 16 refs.

The influence of air pollution on the human body is discussed. Medical examinations carried out in various areas affected by air pollution showed many more cases of chronic bronchitis in the areas with a high density of sulfurous acid gas. The active ciliated tissues in the surface of the bronchial walls will be damaged and become inactive if germs or chemical substances penetrate into the bronchi. As a result of the decline of the original function of the ciliated tissues and their edema, constriction and degenerative atrophy will follow. These conditions favor the formation of bronchial asthma. Floating dust particles are also very harmful to a bronchus as they can become attached in the the alveoli and further enable other harmful gases such as sulfurous acid and carbon monoxide to be absorbed into the epithelial walls. Substances responsible for creating air pollution should be studied more specifically for their chemical nature, fluctuating extent of density, and reactions in which they can occur under the complicated circumstances in the air.

3408 APTIC NUMBER 21192

Yoshida, Katsumi, Yoshikazu Takatsuka, Hidehiko Oshima, and Masayuki Imai
EVALUATION AND EFFECTS OF AIR POLLUTANTS IN SPECIAL AREA. ON THE CASE OF PETROLEUM-COMBINATE. (Tokushu chiiki ni okeru taiki osen busshitsu no hyoka to eikyo. Sekiyu kogai no baai). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 2(2):138-140, Aug. 31, 1968. 7 refs.

A survey of air pollution in Yokkaichi indicated that the total volume of falling dust particles in the area was not always large compared to that of other industrial areas and that the percentage of soluble components in the total volume had increased. The increase is due mainly to the sharp rise of SO4 values in the air. Since 1961 pH values in deposited rainwater in Yokkaichi have continued to decrease. High SO2 emissions from various industries, including a petroleum combine, are responsible for the strong acidification of the air and contribute to chronic bronchitis and bronchial asthma. The analysis of atmospheric sulfur oxide by the glass fiber filter method showed that 64% of SO2 in the air was gathered by filter; almost all of this was recovered as SO4(-2). Sulfur trioxide is present in the air mainly as an isolated sulfuric acid mist. Chronic bronchitis was in parallel relationship with dust fall in a limited area, while bronchial asthma was parallel with the SO2 level. Yokkaichi asthma differs from asthma in other areas in its allergic properties. There were also many cases of chronic bronchitis without asthmatic symptoms in Yokkaichi. The frequency of high-density SO2 and by the correlation between sulfuric acid mist and air pollution are phenomena peculiar to Yokkaichi. Other pollutants observed included vanadium, nitrogen dioxide, and pentachlorophenal.

3409 APTIC NUMBER 21054

Yoshida, Ryo
FUJI ASTHMA. (Fuji Zensoku). Text in Japanese. Igaku No Ayumi (Prog. Med.), 71(7):304-305, Nov. 15, 1969. 7 refs. Chiba Univ. (Japan), Dept. of Public Health.

Fuji city in the prefecture of Sizuoka, with a population of about 170,000, is an important paper manufacturing center. The prevalence of bronchial asthma among the inhibants has given rise to the term Fuji asthma. On many streets of Fuji city pollutants exceed 0.05 ppm, which is the environmental standard established by air quality legislation. Actual conditions were studied at four elementary schools in polluted areas, and also at two elementary schools in nonpolluted areas. The frequency of asthma was 1.38% in the first group and 0.7% in the latter group. Among 109 pupils with asthma, 84% experienced the onset of sickness in Fuji. When the asthmatic pupils were given an antigen liquid positive results were obtained only for 33.3% of the pupils.

3410 APTIC NUMBER 21704

Zabezhinsky, M. A.
THE EFFECT OF INHALATION METHOD FOR INTRODUCTION OF SOME ATOMIZABLE CARCINOGENOUS SUBSTANCES. (Effekt Ingalyatsionnogo Sposobe

Vvedeniya Nekotorykh Rasprylyayushchikhsya Kantserogennykh Veshchestv). Text in Russian. Biull. Eksp. Biol. Med., 69(7):72-74, 1970. 6 refs.

Inhalation of benzidine at a concentration of 10-20 mg/cu m for 4 hours, 5 times per week for 20 months, was studied in albino rats. Of 28 animals surviving through the 13th month, 8 had developed leukemia, fibroadenomas and cancer of the mammary gland, or hepatoma, whereas only two of the 21 rats in the control group had developed adenoma of the mammary gland. Absence of bladder tumors is thought to result from a metabolism peculiarity of rats and does not invalidate the usual method of subcutaneous testing of blastogenic aromatic amino compounds in rats.

3411 APTIC NUMBER 20686

Zavon, Mitchell R. and C. Douglas Meadows
VASCULAR SEQUELAE TO CADMIUM FUME EXPOSURE. Am. Ind. Hyg. Assoc. J., 31(2):180-182, March-April 1970. 11 refs.

The effects of cadmium fume exposure in two men are discussed. One of the men died two weeks after admission to a hospital. Autopsy revealed coronary arteriosclerosis with organizing thrombosis of the circumflex branch of the left coronary artery. There was massive infraction and cor pulmonale. The lungs showed emphysematous changes with interstitial fibrosis, bronchiectosis with endogenous lipid pneumonia, and acute bronchopneumonia. The second man was treated by his family physician for pneumonia, and made a slow recovery over the next three months. He continued to complain of loss of appetite, exertional dyspnea, and increased thirst. The cadmium concentration in the air, shown by a repetition of the original episode, indicated and exposure well above the threshold limit value of 0.1 mg/m.

3412 APTIC NUMBER 21072

Abeles, F. B.
ROLE OF RNA AND PROTEIN SYNTHESIS IN ABSCISSION. Plant Physiol., 43(9), Part B:1577-1586, Sept. 1968. 60 refs.

The role of RNA and protein synthesis in abscission are discussed in terms of a model system, in an effort to construct a hypothesis and examine the available data to see how well they fit the model. Abscission is defined as the process of shedding or separating plant parts, including leaves, stems, fruits, and flowers. The cell separation aspect of abscission is thought to involve the action of specific cell wall degrading enzymes. The hormone responsible for the induction of these enzymes is ethylene, which normally is continuously produced by the explant; the role of ethylene is considered in detail. Enzymes represent synthesis, which in turn is preceded by the synthesis of specific RNA molecules, and it follows that inhibition of either of these processes would also block abscission. Since abscission is a localized phenomenon usually involving two or three cell layers, RNA and protein synthesis should also be localized. Manipulations of plant material which either accelerate or retard abscission may be due to the regulation of RNA and protein synthesis. (Author abstract modified)

3413 APTIC NUMBER 20400

Adams, D. I. and C. W. Sulzbach
NITROGEN DEFICIENCY AND FLUORIDE SUSCEPTIBILITY OF BEAN SEEDLINGS. Science, vol. 133:1425-1426, May 5, 1961. 6 refs.

The influence of nutrition on the susceptibility of beans to visible foliar injury from atmospheric fluorides was studied. Groups of bean seedlings were grown concurrently in cleaned and fluoride-containing (4 to 7 micrograms/cu m) air in plant-growth chambers for 10 and 20 days with six water-culture treatments: Hoaglund's formulation and Hoaglund's minus potassium, calcium, nitrogen, phosphorus, and iron. An inadvertent 15-hour exposure on day 15 (at 42 micrograms/cu m) produced foliar fluorosis symptoms only on the nitrogen-deficient plants fumigated 20 days, although higher fluoride concentrations were present in the foliage of similar plants grown in the other nutrient-deficient solutions. Thus it appears that production of necrosis, within a single variety, is not solely related to the fluoride concentration in the tissue and that fluoride susceptibility must therefore be biochemically associated with other metabolic processes in mechanisms which remain to be elucidated. (Author abstract modified)

3414 APTIC NUMBER 21688

Barrett, Thomas W. and Harris M. Benedict
SULFUR DIOXIDE. In: Recognition of Air Pollution Injury to Vegetation: A Pictorial Atlas. Jay S. Jacobson and A. Clyde Hill (eds.), Pittsburgh, Pa., Air Pollution Control Assoc., 1970, p. C1-C17. 25 refs.

The effects of sulfur dioxide on various plant species are discussed Different species vary in their sensivity to SO2 when exposed to this gas under conditions favorable for its absorption by the plant. Plants which are sensitive to SO2 are shown in tabular form. When SO2 enters the mesophyll tissue of the leaves, it reacts with water to produce the sulfite ion which is oxidized to sulfate ion. The sulfite and sulfate ions are toxic to plant cells when present in large amounts. Because of its reducing potential, the sulfite ion is estimated to be 30 times more toxic than the sulfate ion. The accumulation of sulfite produces two types of markings depending on the accumulation rate: chronic and acute. Chronic injury is characterized by a general chlorotic appearance of the leaf. Acute injury resulting from the absorption of lethal quantities of SO2 appears as marginal or intercoastal areas of dead or necrotic tissues. It is characteristic to find both chronic and acute markings on many species after an SO2 exposure. Plants are more susceptible to SO2 when the sugar content of the leaves is low, such as in early morning. The younger fully-expanded leaves are more sensitive to SO2 followed by the older leaves, while the enlarging leaves are the last to show injury.

3415 APTIC NUMBER 20551

Berge, H.
EMISSION DAMAGE IN FORESTRY. (Skody imisemi v lesnim hospodarstvi). Scientific and Technical Society, Prague, (Czechoslovakia), Agriculture and Forestry Section, Proc. Conf. Effect Ind. Emissions Forestry, Janske Lazne, Czechoslovakia, 1966, p. XVII-1 to XVII-16. 6 refs. (Oct. 11-14.) Translated from Czech., Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, April 24, 1969.

The concepts of absolutely pollution-resistant and fully industry-proof woody plants, which appear especially in forestry textbooks and catalogs, are not true. Forestry is in a worse situation with respect to combatting pollution in comparison with agriculture. Continuous efforts are exerted to achieve the highest standards of soil fermentation. However, optimum nutrition is not always achieved. Examples of Pinus griffithi, Pinus silvestris, Abies concolor, Picea omorika, all leaved trees and conifers, Plantanus acerifolia, Picea oungens, and Juniperus chinensis pfitzeriana show which combined agrochemical and soil problems acquire primary importance in the process of damage assessment. Frequently, conifers are more resistant than leaved trees to emission damage, especially in conditions of intensified fertilizations along with standard liming or application of individual fertilizers in accordance with orographic data and imitation action. With considerations such as type and origin of the plant, together with the type of emission and the use of impact fertilization, emission damage is greatly reduced and sometimes even completely eliminated. This phenomenon was discussed, along with the effects of nitric and phosphoric acid and lime fertilization. It was shown why no general formulas exist for calculating emission damage possibilities and why rigid chemical and mathematical determination systems must be described as unrealistic. It was concluded that more trees and more forests in the vicinity of industrial centers and housing estates are

needed. A mixed forest appears to be the most important producer of oxygen and most efficient filter of waste gases, smoke, and dusts. (Author abstract modified)

3416 APTIC NUMBER 20399

Brennan, Eileen, Ida A. Leone, and Robert H. Daines
THE IMPORTANCE OF VARIETY IN OZONE PLANT DAMAGE. Plant Desease Reptr., 48(12):923-924, Dec. 15, 1964. 5 refs.

Ozone is an air pollutant that causes considerable plant damage, particularly in highly industrialized, densely populated areas of eastern United States. Because the crops affected are of such economic importance, some solution to the problem is necessary. Ozone is created by photochemical reactions in the air involving oxides of nitrogen and hydrocarbons, both products of man's activities. Oat and potato plants were exposed to ozone for 4 hours at concentrations ranging from 0.10 to .31 ppm; 0.10 ppm ozone failed to insure any variety of oats, whereas 0.19 ppm produced symptoms in all varieties, but in varying degrees. Although an attempt is being made to reduce the hydrocarbons contributed by automobiles, the problem of NO2 remains. Since specific varieties of certain susceptible plant species are able to withstand New Jersey's highly oxidized atmosphere, perhaps a partial answer to the problem lies in breeding plants compatible with the pollutants. (Author summary modified)

3417 APTIC NUMBER 21097

Bush, A. F., W. A. Glater, G. Richards, and J. Dyer
EFFECT OF ENGINE EXHAUST ON THE ATMOSPHERE WHEN AUTOMOBILES ARE EQUIPPED WITH AFTERBURNERS. Preprint, California Univ., Los Angeles, Dept. of Engineering Research in Air Pollution Control, 12p., 1963(?).

A simulated ambient atmosphere was tested for contamination by exposing known sensitized plants and by measuring human eye irritation. Two automobile engines equipped with direct flame afterburners supplied exhaust products to a test chamber. Plants were exposed in a greenhouse for 3-5 hours, while eye irritation was tested by a time-concentration method. Smog damage of the conventional type was induced in Nicotiana glutinosa when the ratio of pure air to auto exhaust (without afterburner) was in the range of 1000 to 1. With an afterburner on the exhaust to meet California state standards of 275 ppm hydrocarbons and 1.5% carbon monoxide, a new type of injury was induced in the plants, replacing typical oxidant damage. It is speculated that in the absence of atmospheric hydrocarbons, the hydrocarbons present on the surface of the plant may react in the presence of oxides of nitrogen (acting as photoreceptors), to produce damage. These results may have implications for the effects on humans, animals, and materials of a hydrocarbon removal program not accompanied by sufficient control of oxides of nitrogen. In the eye tests, afterburner exhaust in the chamber showed no appreciable human eye irritation resulting from the new atmosphere, while exhaust without afterburner did produce such effects.

3418 APTIC NUMBER 21498

Chang, Chong W.
EFFECT OF FLUORIDE ON NUCLEOTIDES AND RIBONUCLEIC ACID IN GERMINATING CORN SEEDLING ROOTS. Plants Physiol., 43(5):669-674, May 1968. 24 refs.

An investigation was made to determine the effect of fluoride on plant growth, acid soluble nucleotides, and RNA in germinating corn seedling roots. Fluoride suppressed root growth to a range of two-thirds to one-third the control value depending on fluoride concentration. The rate of growth inhibition was positively related to fluoride content. Column chromatographic analyses demonstrated that fluoride modified ratios of acid soluble nucleotide species. The relative amount of nucleotides is altered mainly due to triphosphate nucleotides of which ATP is most accumulated. Paper chromatographic analyses showed that fluoride induces changes of RNA structure. It is characterized by lowered relative content of cytosine, and by an increased ratio of cytosine to guanine. Adenine is depressed only in the root tissue treated by the highest fluoride concentration (Author abstract modified)

3419 APTIC NUMBER 20909

Cobb, F. W. Jr., D. L. Wood, R. W. Stark, and P. R. Miller
PHOTOCHEMICAL OXIDANT INJURY AND BARK BEETLE (COLEOPTERA: SCOLYTIDAE) INFESTATION OF PONDEROSA PINE. II. EFFECT OF INJURY UPON PHYSICAL PROPERTIES OF OLEORESIN, MOISTURE CONTENT, AND PHLOEM THICKNESS. Hilgardia, 39(6):127-134, May 1968. 4 refs.

A high degree of association between disease caused by atmospheric pollution and incidence of bark beetle infestation in ponderosa pine was demonstrated previously. The present study examined the effects of atmospheric pollution injury on physiological properties of ponderosa pine that may be related to increased susceptibility to bark beetles. Fifty trees, approximately 65-85 years old, were studied in each of three disease classes: healthy, intermediate-diseased, and advanced-diseased. Oleoresin exudation pressure, yield, and flow rate were substantially reduced in severly affected trees, but crystallization of resin increased as severity of disease became greater. Both sapwood and phloem moisture contents were less in diseased trees. Phloem tichness in advanced-diseased trees was less than 60% of that in healthy trees. (Author abstract modified)

3420 APTIC NUMBER 20911

Cobb, F. W. Jr., D. L. Wood, R. W. Stark, and J. R. Parmeter, Jr.
PHOTOCHEMICAL OXIDANT INJURY AND BARK BEETLE (COLEOPTERA: SCOLYTIDAE) INFESTATION OF PONDEROSA PINE. IV. THEORY ON THE RELATIONSHIPS BETWEEN OXIDANT INJURY AND BARK BEETLE INFESTATION. Hilgardia, 39(6):141-152, May 1968. 102 refs.

The behavior of bark beetles in attacking ponderosa pines in an

advanced state of chlorotic decline is considered in three phases. The first is the dispersal phase, which begins with emergence from brood trees and ends with initial boring activity in the selected host. The second is the concentration phase during which successful penetration through the outer bark into the phloem tissue occurs. This activity results in the production of an attractant and subsequent mass attack. The third phase, establishment, includes the construction of egg galleries, oviposition, and the development of the brood from egg to adult. The lack of evidence of beetle attack on healthy trees may result from the inhibition of boring activity by some unknown host factory. Bark beetles could be attracted to injured trees by the color of the chlorotic foliage or the odor of respiratory fermentation products. The reduced rate of oleoresin flow and yield associated with air pollution injury may lower host resistance to attack. Reductions in phloem carbohydrates and phloem thickness, also associated with air pollution injury, could influence the concentration phase. The effects of photochemical air pollution on the properties of oleoresin affecting initial penetration are also postulated to be operative during the establishment phase. Reduction in exudation pressure, flow rate, yield, and the rapid crystallization of oleoresin may affect the amount of toxic vapors to which the beetle is exposed.

3421 APTIC NUMBER 20190

Cole, Gordon A.
AIR POLLUTION WITH RELATION TO AGRONOMIC CROPS: III. VEGETATION SURVEY METHODS IN AIR POLLUTION STUDIES. Agron. J., vol. 50: 553-555, 1958.

Before seven proposed major steam-electric plants began operation, a study of the control of airborne emissions from these plants was initiated. One phase of the study was the development of a field surveillance program to evaluate the effects of the fumes on native vegetation. This program was centered around the use of indicator species. Characteristics desirable for any species selected as an indicator were as follows: sensitivity to SO2 below the sensitivity level of vegetation of economic or aesthetic importance; wide distribution in the area of interest; presence throughout the growing season; and growth from the terminal shoot throughout the growing season. The indicator species mainly used for surveillance were Blackberry, Giant Ragweed, Helianthus sp., Cranesbill, and Blackjack oak. The field surveys are conducted by making use of smoke dispersion patterns, topographic maps, indicator species, meteorological records, and autometer records. Plume behavior is important in the planning of a survey schedule. The dispersion pattern closely follows seasonal weather trends. Topographic maps permit easy alignment of findings in relation to direction and distance from the plant. The various indicators are available at different times during the growing season, and some are selective in their habitats. All through the growing season, various confusing factors may be present, such as frost, drought, insects, herbicides, and various diseases that affect vegetation from time to time. The use of control areas and a continuing study of weather data are useful in understanding survey findings.

3422 APTIC NUMBER 21068

Coney, H. Melvin
INHIBITION OF GERMINATION OF ALTERNARIA SPORES BY SULFUR DIOXIDE UNDER VARIOUS MOISTURE CONDITIONS. Phytopathology, vol. 55:525-527, May 1965. 3 refs.

Reduction of germination of Alternaria spores after exposure to sulfur dioxide was quantitatively proportional to the SO2 concentration and to the exposure time. Wet spores were more sensitive than dry ones to SO2, although the sensitivity of dry spores increased rapidly when they were placed in a water-saturated atmosphere. Spores incubated at low relative humidities were more resistant to SO2 than wet spores or those hydrated in a saturated atmosphere for four hours. During the routine fumigation of grapes in storage, the SO2 concentration at the usual 90% relative humidity is sufficient to make the survival of Alternaria spores unlikely. (Author abstract modified)

3423 APTIC NUMBER 21046

Davis, D. R. and C. E. Dean
LOW-LEVEL TROPOSPHERIC OZONE. Monthly Weather Rev., 94(3):179-182, March 1966. 18 refs.

Non-industrially produced ozone is identified as the cause of damage to tobacco crops in the contiguous area of northern Florida and southern Georgia. The ozone is believed to be stratospheric in origin, having been transported to the lower troposphere by an extratropical storm. The damage was estimated at $284,000, affecting 800 acres or one seventh of the area crop. Tobacco leaves are most susceptible to this type of damage at one stage of development. Late planting and difference in varieties grown were the primary reasons that the damage was not significant on the remainder of the acerage devoted to tobacco. The normal ozone concentration for the area is 0-4 parts per hundred million (pphm) by volume. The concentration of 9 pphm was the first occurrence sufficiently high to damage the tobacco materially. Over the years, similar damage has been reported to tomatoes and other crops in the area.

3424 APTIC NUMBER 21071

Devor, K. A. and J. B. Mudd
ACETATE BINDING OF SPINACH CHLOROPLASTS AS A FACET OF FATTY ACID SYNTHESIS. Plant Physiol., 43(6):853-858, June 1968. 18 refs.

Experiments are described investigating fatty acid synthesis in spinach chloroplasts broken by osmotic shock, a process which requires both a particulate and soluble fraction. The preparation of chloroplast fractions and the protein concentration of each fraction are described. The particulate fraction of the chloroplasts is the major site of binding when either acetate or acetyl-CoA is used as substrate; this bound acetate behaves as a precursor in fatty acid synthesis. The acetate is linked covalently, and the binding is inhibited by reagents with sulfhydryl groups. The amount of acetate bound is lowered by

The atmosphere in which seeds germinate can affect the level of germination and dormancy. Dehusked and entire wild oat seeds were germinated in light and darkness at 20 C in atmospheres containing 0, 3 and 20% carbon dioxide with variations in the amount of oxygen present. The residula volume was made up with Argon. Germination of partially dormant seeds is inhibited by white light, which is most apparent when the caryopsis is enclosed in the pales. While oxygen is a necessary factor in the germination of this species, carbon dioxide also has an effect. A lack of CO2 increases the degree of light inhibition; 3% CO2 allows germination in light; 20% CO2 inhibits germination in light and darkness at all tested oxygen concentrations. (Author abstract modified)

3430 APTIC NUMBER 20707

Hasegawa, T. and H. Yoshikawa
ON THE ATMOSPHERIC FLUORIDE POLLUTION. PART I. (Fukkabutsu ni yoru taiki osen chosa (1)). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):147, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.) PART II. Ibid., 4(1):148, 1969.

Fluorine compounds emitted from chemical fertilizer, ceramics, and chemical industries were suspected to be the cause of death of 70 oxen for agricultural use between 1953 and 1964 in the outskirts of Osaka. Fluoride analysis was conducted on the urine of Japanese oxen in the area in order to determine the extent to which fluorides in air enter grass and feed. Fluoride content was found to be as high as 20 ppm. Further investigation was performed in order to determine the relationship between the fluorine compound content in the bones of the dead oxen and dust fall, plants, animal feed, and soil characteristics. A substantial amount of fluorides was discovered in the bones, and it became apparent that the compounds originated from the factories. It was not obvious whether they were the direct cause of death, because some inorganic fluorine compounds do not lead to death even at high concentrations. Since the oxen were also used for ploughing the fields, conclusions could not be drawn as to the real effects of the fluorides on the animals.

3431 APTIC NUMBER 20708

Hasegawa, T. and Y. Yamazaki
ON THE ATMOSPHERIC FLUORIDE POLLUTION. PART II. (Fukkabutsu ni yoru taiki osen chosa (2)). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):148, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.) PART I. Ibid., 4(1):147, 1969.

In East Osaka, agricultural crops either died or showed poor growth in the neighborhood of a factory producing white cosmetic bottles. Since fluorite was used as a material and there was no damage before the establishment of the factory, it was suspected that fluorine compounds were causing the damage. Quantitative analysis was performed on the agricultural crops and the exhaust gas as well as the dust particles in order to determine the fluorine content. Gas samplers were used to collect the dusts from the surrounding atmosphere. Fluorine content of dust near the factory was on the average about 93 mg per cubic meter per day, and in some parts, as high as 1.54 mg per cubic meter per day. Relatively larger quantities of fluorine were measured at the southwestern and southeastern area of the factory, corresponding to the general wind pattern. Rice and soy beans from the neighborhood of the factory showed concentrations of fluorine and, especially in the leaves of the damage crops, the concentrations were several hundred times higher than those of the undamaged leaves.

3432 APTIC NUMBER 20266

Hashiguchi, K., K. Oda, T. Sugita, and H. Sato
INFLUENCE OF AIR POLLUTION ON PLANTS IN OSAKA AREA. (Taikiosen no shokubutsu ni oyobosu eikyo chosakekka). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):132, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The influence on plants by rainwater containing various degrees of air pollution was studied. Rainwater was collected at four separate locations in Osaka; the subjects were mainly limited to duckweeds. Quantitative analysis of rainwater was not complete, but it was clear that rainwater in Osaka does contain substances such as copper ions that stifle plant and tree growth in the long run. In addition, a pilot study using an artificial environmentalcontrol system and an air purification system, a comparative cultivation under polluted and non-polluted conditions, was conducted. The air-purifier simply involved passing air through water, but it eliminated a substantial amount of sulfur dioxides and other suspended solids. The plants lost a great deal of moisture in the glass case of the artificial environmental control system, and a decision was made to limit all future cultivations to plants durable to dehydration and to improve the irrigation methods.

3433 APTIC NUMBER 21691

Heck, Walter H., Robert H. Daines, and Ibrahim J. Hindawi
OTHER PHYTOTOXIC POLLUTANTS. In: Recognition of Air Pollution Injury to Vegetation: A Pictorial Atlas. Jay S. Jacobson and A. Clyde Hill (eds.), Pittsburgh, Pa., Air Pollution Control Assoc., 1970, p. F1-F24. 54 refs.

The effects of several phytotoxic pollutants are considered. Ethylene acts as a growth hormone; it causes a reduction in growth, stimulates lateral growth, and decreased apical dominance. Plant leaves may develop epinasty or show chlorosis, necrosis, or abscission. Injury from oxidants other than ozone, PAN, or nitrogen dioxide may be chronic or acute. These oxidants, none of which have been identified, may cause necrosis, collapse of leaf tissue, and dehydrated and bleached lesions. Cotton leaves affected by herbicides show a yellow-green mottling or stippling and vein clearing may be pronounced. Tomatoes may show epinasty and twisting of plant parts. Arsenic trioxide injury on sensitive fruit and vegetable crops produces necrotic spots on the leaves, petioles, twigs, and fruits. Mild to severe interveinal necrosis and chlorosis may occur on broad-leaved plants as a result of atrazine. Necrosis, chlorosis, and

epinasty are the common symptoms of chlorine injury. Acute tissue collapse and necrotic spotting have resulted from ammonia injury. Discoloration of peach and apple fruits have also been reported. Hydrogen chloride caused an acid-type necrosis. Tipburn to fir needles and necrosis along leaf margins have also been noted after HCl exposures. Mercury causes chlorosis, abscission of older leaves, growth reduction, and general poor growth and development. The effects of particulates, hydrogen sulfide, and carbon monoxide are briefly discussed.

3434 APTIC NUMBER 20345

Hibben, C. R.
PLANT INJURY BY OXIDANT-TYPE POLLUTANTS IN THE NEW YORK CITY ATMOSPHERE. Plant Disease Reptr., 53(7):540-548, July 1969. 21 refs.

Snowstorm petunia, W1 tobacco, eastern white pine, common hybrid lilacs, and oxidant-sensitive rubber strips were exposed to the Brooklyn atmosphere in unfiltered and carbon-filtered growth chambers. The cracked rubber strips and oxidant-type symptoms on the plants, including adaxial and bifacial flecks and abaxial glaze and discoloration, demonstrated the presence of oxidants at phytotoxic concentrations. The W1 tobacco and eastern white pine were injured the most severely. Symptoms resembling those caused by ozone on plants in the unfiltered chambers, and the inducement of identical symptoms by experimental fumigation with ozone, implicated this gas as one of the phytotoxicants. (Author abstract)

3435 APTIC NUMBER 21689

Hill, A. Clyde, Howard F. Heggestad, and Samuel N. Linzon
OZONE. In: Recognition of Air Pollution Injury to Vegetation: A Pictorial Atlas. Jay S. Jacobson and A. Clyde Hill (eds.), Pittsburgh, Pa., Air Pollution Control Assoc., 1970. p. B1-B22. 47 refs.

Ozone probably causes more injury to vegetation than any other air pollutant in the United States. Varietal and species differences in ozone sensitivity have been observed. Some of the species which have been injured in the field or which have appeared sensitive in fumigations are listed. The most common symptom on many deciduous trees and shrubs is localized thickening and pigmentation of the cell walls resulting in sharply defined small dot-like lesions. Small unpigmented necrotic spots or more general upper-surface bleaching is a common type of injury on most herbaceous and many wooded species. When all of the tissue of the leaf is killed, relatively large bifacial necrotic areas develop. Necrotic tissue ranges from white to orange-red depending on the species. On leaves with palisade parenchyma, chlorotic lesions are usually limited to small groups of palisade cells, and the injury is observable primarily on the upper leaf surface. Grasses with undifferentiated mesophyll may develop a fine chlorotic stippling on either surface. Chlorotic mottling and flecks are the common symptoms on pine. Symptoms of ozone injury on selected species are also discussed.

3436 APTIC NUMBER 20902

Hooper, Gary R. and William W. Thomson
CRYSTALLOID STRUCTURES IN MICROBODIES AND MITOCHONDRIA OF CITRUS. J. Microscopie, 7(6):935-938, 1968. 6 refs.

The occurrence of crystalloid materials in microbodies and mitochondria of virus-infected and healthy citrus plants is evidence that the substances are not a by-product of virus infection, while it is possible that the crystalloids represent some aspect of protein accumulation and utilization in these plants. The microbodies were single membrane bound with a central crystalloid which appeared to be composed of stacked, tubular units that were hexagonal in cross section. Sections along the plane of stacking appeared banded with parallel, electron-opaque lines at 200 A intervals, while sections cut perpendicular to the plane of stacking exhibited a 'honeycomb' appearance of hexagonal units 200-210 A in diameter. Mitochondria of cortical and leaf parenchyma cells occasionally contained one or more crystal-like structures, which although irregular in size and shape were usually variations of a rectangular form. A definite arrangement of electron-opaque lines was usually evident at 90 A intervals.

3437 APTIC NUMBER 21472

Hull, Herbert M., F. W. Went, and Noboru Yamada
FLUCTUATIONS IN SENSITIVITY OF THE AVENA TEST DUE TO AIR POLLUTANTS. Plant Physiol., vol. 29:182-187, 1954. 15 refs.

A daily and seasonal fluctuation in sensitivity of the Avena test to given concentrations of the plant growth hormone auxin has been observed. Experiments to determine the effect of air pollutants involved fumigation of Avena seedlings with a low concentration of synthetic smog. Exposure resulted in a decreased curvature, the decrement being directly proportional to the concentration of indole-3-acetic acid applied, at concentrations ranging from 0.04 to 5.0 mg/l. This repressive effect was much greater when the fumigation was given during the first or second day of germination as compared with the third or final day of growth. When Avena tests were carried out every three hours over a 24 hour period simultaneously in filtered and unfiltered air, the diurnal fluctuation which occurred in the plants grown in unfiltered air was absent in those grown in filtered air. This indicates that the variability in sensitivity was a result of fluctuating concentrations of air pollutants. It is suggested that the cause of decreased response to applied auxin lies in an effect on the growth response of the coleoptile. (Author summary modified)

3438 APTIC NUMBER 20870

Jacobson, Jay S. and D. C. McCune
INTERLABORATORY STUDY OF ANALYTICAL TECHNIQUES FOR FLUORINE IN VEGETATION. J. Assoc. Offic. Anal. Chemists, vol. 52:894-899,

Sept. 1969. 21 refs. (Presented at the 60th Annual Meeting of the Air Pollution Control Association, Cleveland, Ohio, June 14, 1967.)

An interlaboratory study of fluorine analyses on plant tissues was performed to determine the current levels of within- and between-laboratory precision. Homogeneous, ground, fluorine-containing leaf tissues of alfalfa, citrus, gladiolus, pine, and orchard grass were analyzed by the routine methods currently in use in 41 different laboratories. The data reported by the laboratories are summarized. The mean values obtained for each tissue are as follows: alfalfa, 53.2 ppm; citrus, 117.5 ppm; gladiolus, 54.0 ppm, pine, 74.4 ppm; and orchard grass, 55.3 ppm. The variation between laboratories was estimated by calculating standard deviations, which ranged from 11.0 ppm for alfalfa to 14.0 ppm for citrus tissues. Relative standard deviations ranged from 12.7% for citrus to 24.5% for gladiolus. Deviations between the fluorine content of paired samples provide estimates of within-laboratory reproducibility. Some laboratories obtained highly reproducible results, but 14 reported at least one pair of duplicate values which differed from each other by 10 ppm or more. The results show that, despite the use of generally similar methods, there are marked differences in procedures, techniques, and reagents from laboratory to laboratory. A marked improvement in agreement is urgently needed to improve the usefulness of current fluorine measurements.

3439 APTIC NUMBER 20573

Kaudy, J. C. F. T. Bingham, R. C. McColloch, G. F. Liebig, and A. P. Vanselow
CONTAMINATION OF CITRUS FOLIAGE BY FLUORINE FROM AIR POLLUTION IN MAJOR CALIFORNIA CITRUS AREAS. Proc. Am. Soc. Hort. Sci., vol. 65:121-127, 1954. 22 refs.

As a preliminary phase of an investigation of the effect of fluorine on citrus growth, the extent of fluorine contamination in citrus foliage was determined. Leaves from approximately 130 citrus groves, collected in both heavily polluted areas and areas far removed from pollution, were analyzed for fluorine. Citrus leaves from the Coachella Valley of Riverside County, and from San Diego, Ventura, and Tulare counties disclosed concentrations of 1 ppm F or less. Leaves collected in industrialized areas disclosed values up to 211 ppm F. The greatest fluorine accumulation was evident in leaves from the San Bernardino Valley, San Bernardino County, especially from the vicinity of Fontana, where a steel plant is located. Significantly elevated accumulations were also found in leaves from the Los Angeles area, presumably as a result of emissions from aluminum, ceramic, phosphate, and chemical plants. Elevated fluorine values were not associated with any visible damage to the trees. Sampling of leaves of 12 groves over a 9-month period disclosed a maximum accumulation of fluorine during the summer and fall months. Foliar concentrations of fluorine increased very little, once the winter rains began. (Author summary modified)

3440 APTIC NUMBER 20901

Kramer, C. L. and S. M. Pady
SPORE DISCHARGE IN HYPOCREA GELATINOSA. Mycologia, 60(1):208-210, Jan.-Feb. 1968. 2 refs.

Wood collections bearing various Pyrenomycetes and Hymenomycetes were placed on wet peatmoss in plastic trays and stored in a mist chamber in a greenhouse to determine the periodicity of spore discharge correlated with alternating periods of light and dark. Hypocrea gelatinosa began to appear about 8 weeks after branches bearing old sporophores of Stereum had been placed in the mist chamber. When subjected to alternating 8-hour light (8 am-4 pm) and 16-hour dark periods with temperature (75 F) and relative humidity (85%) held constant, spore discharge began to increase 2-3 hours before the lights were off, gradually rose to a peak at 2-3 am, then declined sharply to a low during the day. This same diurnal pattern was maintained for about 2 days when subjected to continuous dark following conditioning in alternating light and dark, but when submitted to continuous light following the conditioning, spores were discharged at a relatively constant rate.

3441 APTIC NUMBER 21194

Kuribayashi, Shigeharu
INJURY OF MULBERRY TREES BY AIR POLLUTION. (Taikiosen ni yoru yoso no higai). Text in Japanese. Sanshi Kagaku to Gijutsu (Sericultural Sci. Technol.), 8(8):64-67, Dec. 1969.

Atmospheric pollutants and their effects on mulberry leaves are discussed. At present the diagnosis of the effect of air pollution is largely dependent on chemical analysis and observations of the growth of mulberry trees and of silkworms, together with simultaneous analysis of atmospheric and soil samples. In observing symptoms of injury, it is important to remember that some symptoms may be transient or analogous to those caused by insects or fertilizers. For this reason, a comparative study of injured and healthy leaves should be undertaken to determine the level of injury and the responsible sources. The types of injuries caused by different pollutants are outlined. Dechlorized and spotted leaves are representative of the effect of 0.1-0.2 ppm, or higher concentrations of silkworms fed these leaves initially show loss of appetite, then inhibited growth, and finally death. The visible symptoms produced by 150-200 ppm hydrogen fluoride gas are brown spots at leaf tips and edges. Levels half as low are sufficient to kill silk. Silkworms leaves injured by chlorine gas also show decreased appetite and sometimes vomit silk thread. Gaseous contaminants containing stack smoke and carbon particles are generally sticky, insoluble in water, and extremely detrimental to the growth of mulberry trees. The effect of dusts and suspended particles from adjacent plants varies according to size and components.

3442 APTIC NUMBER 21193

Kuribayashi, Shigeharu
PUBLIC NUISANCE AND SILK GROWING INDUSTRY. (Kogai to Yosan).

Text in Japanese. Sanshi Gijutsu (Sericultural Technol.), no. 66-67:33-37, March 1968. 3 refs.

The silk industry has recently begun to feel the impact of air pollution from dust fall and toxic gases containing sulfur,

chlorine, and hydrogen-fluoride. This article discusses appropriate countermeasures for abating sericultural damages from two sources of pollutants: industrial emissions and agricultural chemicals. Of the two types of approaches to controlling pollutants from plants, the most drastic and most effective is not yet feasible because of costs associated with its enforcement. This approach would specify strict regulations for industrial plants and also require all roads to be paved. A more practical alternative is to establish segregated zones for silk growing industries. With regard to agricultural chemicals, the periodical cycle between the rearing of silkworms and the spraying of the chemicals should be adjusted. Although agricultural chemicals do not have a favorable effect on silkworms, their drastic curtailment is not recommended. Such a measure would bring about the problem of insect propagation or retard the development of less injurious chemicals. What is needed instead is a system of cooperation between the growers of mulberry trees and those who use the leaves to feed silkworms.

3443 APTIC NUMBER 21092

Laseter, J. L., J. Weete, and D. J. Weber
ALKANES, FATTY ACID METHYL ESTERS, AND FREE FATTY ACIDS IN SURFACE WAX OF USTILAGO MAYDIS. Phytochemistry, vol. 7:1177-1181, 1968. 7 refs.

The external surface of fungal spores is covered by waxy deposit; believed to be involved in maintaining water balance and providing a barrier to substances penetrating into the spores. Because the outer surface is continually exposed to the environment, the nature of the waxy layer is an important factor in the survival of fungal spores. The wax fraction from chlamdospores of Ustilago maydis (Basidiomycetes) was analyzed by a new combination of gas chromatographic and mass spectrometric techniques. The hydrocarbon fraction contained predominantly C25, C27, and C29 n-alkanes. A second fraction eluted from a silica gel column contained natural methyl esters of both saturated and unsaturated acids, with esters from C12 through C20 predominating. The methyl esters of C18 mono and dienoic fatty acids were present in abundance. The free fatty acid fraction contained fatty acids with carbon numbers from C12 through C20. The distribution of carbon skeletons was similar in both the free acids and natural methyl esters; the predominant compounds had even carbon number chains. It is likely that the methyl esters of fatty acids and the free fatty acids are associated in the wax complex similar to the methyl esters of galacturonic acid and free galacturonic acids in pectin. It is also possible that the natural methyl esters function as a reserve energy source as well as a protective layer. (Author abstract modified)

3444 APTIC NUMBER 20471

Laseter, J. L., W. M. Hess, J. D. Weete, D. L. Stocks, and D. J. Weber
CHEMOTAXONOMIC AND ULTRASTRUCTURAL STUDIES ON THREE SPECIES OF TILLETIA OCCURRING ON WHEAT. Can. J. Microbiol., 14(10):1149-1158, 1968. 16 refs.

Electron microscopic investigations and chemical analyses were performed to explore the possibility of using the lipids found in the spore walls and the ultrastructure of these walls by means of the freeze-etch technique to differentiate between three closely related species of Tilletia, which cause disease in wheat. The spore walls of both T. foetida (smooth external surface) and T. caries (reticulate surface with some hair-like projections) contain two layers. The spore wall of T. controversa (complex reticulate surface with many hair-like projections) contain three layers. The outer layer in T. controversa has granular regions which form a reticulated pattern on the surface. The hydrocarbon content of the three Tilletia species was essentially the same. The compounds in benzene and the methanol (free fatty acids) fractions gave distinct gas chromatographic patterns for each of the three species. T. foetida was the highest in saturated fatty acids with T. controversa second, followed by T. caries. The reverse situation existed with respect to the unsaturated fatty acids. (Author abstract modified)

3445 APTIC NUMBER 20468

LeBlanc, Fabius
THE EFFECT OF AIR POLLUTION ON CORTICOLOUS EPIPHYTES IN METROPOLITAN REGIONS. (Influence de l'atmosphere polluee des grandes agglomerations urbaines sur les epiphytes corticoles). Text in French. Rev. Can., Biol., 20(4):823-827, 1961. 9 refs. (Presented at the 29th Congress of ACFAS, Ottawa, October 27-29, 1961.)

The phytosociology of corticolous epiphytes was studied in Southern Quebec where these plants are particularly abundant. However, trees were completely free of epiphytes in the center of Montreal; and within a radius of 15-18 miles around Montreal, these plants reappear, but have a limited vitality. It is only outside this territory that societies of corticolous epiphytes become abundant and well developed. A discussion on the ecology of lichens is also included: whether it is sulfur dioxide in the air or factors which lower the relative humidity that contribute to the scarcity of corticolous epiphytes in urban areas. (Author abstract modified)

3446 APTIC NUMBER 21366

Lee, T. T.
EFFECT OF OZONE ON SWELLING OF TOBACCO MITOCHONDRIA. Plant Physiol., 43(2):133-139, Feb. 1968. 25 refs.

The swelling of mitochondria isolated from leaves, roots, and callus tissues of Nicotiana tabacum was measured by observing the changes in optical density at 520 millimicrons in buffered 0.25 M sucrose or 0.125 M KCl. Ozone induced rapid swelling of the isolated mitochondria and increased the permeability of mitochondrial membranes. The extent of mitochondrial swelling and the amount of soluble proteins and other substances released

from mitochondria into the suspending medium were positively correlated with the length of exposure to O3. Protocatechuic acid, when initially present in the suspending medium, completely prevented O3-induced swelling. Reduced glutathione, ascorbate, and L-cysteine partially prevented O3-induced swelling. Polyvinylpyrrolidone (PVP) and bovine serum albumin (BSA) induced contraction of tobacco mitochondria in the absence of O3, but did not reverse swelling of O3-treated mitochondria. PVP and BSA only stopped O3-induced swelling. Contraction of tobacco mitochondria occurred rapidly at acid pH, but the contracting state affected by acid pH did not protect mitochondria from O3-induced swelling. Although O3 induced greater swelling at acid pH, the O3-treated mitochondria were still responsive to acid-induced contraction. (Author abstract modified)

3447 APTIC NUMBER 21471

Linzon, S. N.
THE DEVELOPMENT OF FOLIAR SYMPTOMS AND THE POSSIBLE CAUSE AND ORIGIN OF WHITE PINE NEEDLE BLIGHT. Can. J. Botany, vol. 38:153-161, 1960. 24 refs.

Needle blight of eastern white pine is characterized by an orange-red discoloration of the distal portions of the current year needles. At Chalk River, Ontario, 600 seedlings and saplings of white pine were examined repeatedly throughout the 1957 and 1958 growing seasons for the appearance and development of needle blight symptoms. The first of these were faint pinkish spots on the stomata-bearing faces of needles in semimature tissue. These developed rapidly into orange-red bands which within a few days spread to the needle tips. Attacks which occurred in the early summer killed only limited areas at the tips of needles, whereas those that occurred when the needles were nearly full-grown involved most of their length. Needle blight incidence was confined to a few major outbreaks during one season, in which many trees developed typical symptoms at essentially the same time. Each of these major outbreaks occurred after one or more days of wet weather followed suddenly by a continuous sunny period. No microorganisms were isolated from tissues displaying the initial needle blight symptoms. Susceptibility to the unfavorable conditions which incite needle blight is suggested to be inherent in the individual, and that differences in response among members of a local population depend on variations in susceptibility, rather than on a varying local predisposition among uniformly susceptible individuals. The blight is initiated in semimature leaf tissues only, but then spreads distally throughout adjacent, more mature tissues with a similar pattern of breakdown. (Author abstract modified)

3448 APTIC NUMBER 21126

Lux, H.
ESTIMATION OF THE PROPORTION OF TOTAL DAMAGE CONTRIBUTED BY EACH OF SEVERAL SOURCES OF STACK GASES WHICH SIMULTANEOUSLY AFFECT FOREST VEGETATION. (Prispevek k vymezeni podilu skod zdro ju kourovych plynu, soucasne pusobichich na lesni vegetaci). Scientific and Technical Society, Prague (Czechoslovokia). Agriculture and Forestry Section, Proc. Conf. Effect Ind. Emissions Forestry, Janske Lazne, Czechoslovakia, 1966, p. IV-1 to IV-10. 9 refs. (Oct. 11-14.) Translated from Czech. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, April 24, 1969.

A method used in the evaluation of assessment for industrial plants causing smoke damage to exhausts is reviewed and described. When exhausts differ chemically, it is better to limit the proportions by air analysis than from damage symptoms. A local-terrain diagnosis is necessary. Conversely, the enumeration of emissions is a procedure which offers favorable results at comparatively little cost, particularly in the case of large damaged areas and numerous emission sources. A large-scale diagnosis was carried out in the Dubner Heide area affected by factories in the vicinity of Bitterfield. The procedure is described. Calculations using this method show an error of plus five percent for a straight-line polygonal test pattern. Emission maps of eight most important large-scale emission sources in the Bitterfield area were used in order to calculate their share of the damage in the zones of the forests at Possau, Dubner Heide, and Torgau. The results are tabulated. The percentage shares are shown separately for each zone of damage. The mean heights of stacks and sulfur dioxide values show that factories with the highest rate of emissions usually contribute the greatest share. Low stacks and presence of forests always cause increased values, particularly in heavily damaged zones.

3449 APTIC NUMBER 21463

Macdowall, F. D. H.
STAGES OF OZONE DAMAGE TO RESPIRATION OF TOBACCO LEAVES. Can. J. Botany, 43(4):419-427, April 1965. 23 refs. (Presented at the Am. Phytopathol. Soc., Annu. Meet., Corvallis, Ore., Sept. 1962.)

Respiration, photosynthesis, oxygen uptake, chlorophyll levels, and various biochemical activities were measured in samples of lamina from matured, ozone-susceptible leaves of 'White Gold' tobacco grown in field and greenhouse locations. Whole plants were fumigated in sunlit chambers or plastic tents, while leaf discs from susceptible plants were fumigated in an illuminated glass container in a laboratory fume hood. A damaging dose of ozone initially inhibited the respiration of fumigated leaves and of mitochondria removed from them. Stimulation of leaf respiration occurred later, together with visible signs of damage and inhibition of photosynthesis. Mitochondria prepared from such visibly damaged tissue also showed stimulated activity. However, their cytochrome oxidase activity was inhibited and their oxidative phsphorylation was suppressed, like known effects of cyanide and carbon monoxide. Possible mechanisms underlying these effects are discussed. (Author abstract modified)

3450 APTIC NUMBER 21018

Naeno, M.
EFFECTS OF AIR POLLUTION ON TREES. V. HEAVY METALS IN LEAF OF STREET TREES STUDIES ON DETERMINATION OF LEAD BY ATOMIC ABSORPTION SPECTROSCOPY AND RESULTS OF SOME MEASUREMENTS. (Jumoku ni taisuru taiki osen no eikyo: dai-goho. Gairojuyo no jukinzoku. Genshiryukoho ni yoru namari no sokuteiho no kento to sokuteirei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution,) 4(1)136, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The effect of pollution on plants and trees from automobile exhausts was estimated by measuring the distribution of lead content of trees by means of atomic absorption spectroscopy. Attention was paid to the conditions of observation, the effects of coexisting elements, the methods of decomposing the samples, and the rate of data retrieval. Ginqko, platanus, Chinese parasol, and horse chestnut trees were observed from ten locations in the Tokyo-Yokohama area. Ginqko ranged from 17 to 116 ppm with an avaerage of 49 ppm in lead content, and platanus ranged from 17 to 34 ppm with an average of 25 ppm. The locational difference in the contents indicated that there is a close relationship between lead content and traffic volume; and in addition, the period of June to July was the time of increase of lead content. The dust (insoluble components) on the leaves had values ranging from 650 to 1318 ppm with an average of 932 ppm.

3451 APTIC NUMBER 21482

Naeno, M.
EFFECTS OF AIR POLLUTION ON TREES. PART IV. SEASONAL CHANGES OF SULFUROUS CONSTITUENT IN LEAF OF STREET TREES. (Jumoku ni taisuru taiki osen no eikyo. (4). Gairojuyo no iwokeital no jikitaki henka). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):135, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

There is a close relationship between sulfur dioxide concentration in air and sulfur content in trees, and the long-term contact of trees with sulfur dioxide gas in air pollution apparently leads to the decline in their population. However, since sulfur is relatively abundant in soil and is an important constituent of a tree, it is difficult to determine the absolute quantity of sulfur that invades the tree through the leaves. Planted trees along the streets (ginkgo, platanus, Chinese parasol, and horse chestnuts) from ten industrial as well as non-industrial locations in the Tokyo-Yokohama area were tested for sulfur content by means of fractional quantitative analysis according to water-soluble, acetate-soluble, and insoluble categories of sulfur compounds. Seasonal fluctuations in the sulfur concentration in the leaves were recorded for trees in the industrial areas and non-industrial areas and the results were compared.

3452 APTIC NUMBER 21443

Matsuoka, Y., O. Udagawa, and T. Ono
EFFECTS OF SULFUR DIOXIDE ON PEAR POLLINATION. (Nashi no juseisayo ni oyoboSu oryusanqasu no eikyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):130, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

In Chiba Prefecture, the fructification and the harvest of pears is usually declining in areas under chronic atmospheric pollution. Using Chojuro type pear trees and the pollen from Nijusseiki type pear trees with a 70% germination rate, the effect of sulfur dioxide was investigated. The trees were placed in a glass chamber under the optimal condition for blossoming and subsequently the flowers were treated with 0.2 ppm and 0.5 ppm sulfur dioxide before, during, and after artificial pollination for the average period of eight hours. The number of resulting fruits and their seeds were recorded and tabulated. The 0.5 ppm gas had the greatest effect with a vast reduction in the number of fruits, especially for flowers treated during pollination. The sulfur dioxide gas apparently hinders the germination of pollen on the stigma rather than reducing the functional ability of pistil due to physical damage.

3453 APTIC NUMBER 21493

Matshushima, J. and M. Harada
SULFUR DIOXIDE GAS INJURY TO FRUIT TREES. II. ACTUAL CONDITIONS OF SUFFERED CITRUS TREES AND SURVEY OF THEIR NUTRITIONAL STATUS. (Kaju no aryusanqasu niyoru engai (dai 2 ho) Higai kankitsuju no jittai narabini sono eiyokakuteki kansatsu.) Text in Japanese. Engei Gakkai Zasshi (Tokyo), 34(3):169-176, 1965. 19 refs.

The actual conditions and the results of leaf analysis of Satsuma orange trees exposed to smoke pollution are discussed. Most of the leaves showed symptoms of sulfur dioxide injury, and some showed signs of sulfuric acid mist injury. Some leaves fell rapidly without showing any diseased spots. No significant correlation was found between the soil pH and the SO2 concentration in the atmosphere. The sulfur content of the leaves was high, and it was highly correlated with the SO2 concentration in the air. The sulfur content increased with leaf age from July 1963 to January 1964. Its increasing rate was greatest when the SO2 gas flowed in the orchard. A high negative correlation existed between the sulfur and calcium contents of leaves, having the coefficient of -0.67. The potassium and manganese contents increased as the sulfur content increased, but no correlation was found. The composition of nutritional elements in Satsuma orange trees seems to be affected directly or indirectly by the SO2 concentration in the air.

3454 APTIC NUMBER 21000

McCune, D. C., L. H. Weinstein, and Jill F. Mancini
EFFECTS OF HYDROGEN FLUORIDE ON THE ACID-SOLUBLE NUCLEOTIDE METABOLISM OF PLANTS. Contrib. Boyce Thompson Inst., 24(19):211-225, Jan.-March 1970. 26 refs. (Presented at the Air Pollution Control Association 60th Annual Meeting, Cleveland, Ohio, June 11-16, 1967.)

Experiments were undertaken to explore the problem of fluoride effects on phosphorus metabolism in reference to acid-soluble nucleotides in 'Tendergreen' and 'Pinto' beans, 'Bonny Best' tomatoes, and 'Marcross' corn. Procedures and methods are described for six distinct experiments. Hydrogen fluoride (HF) in the atmosphere at concentrations of 4.8 to 10.7 mg Fluorine/cu m for periods of 4 to 12 days had no consistent effect on the levels or compostion of acid-soluble nucleotide pools in leaves of the plants. The distribution of phosphorus (P) among the various nucleotide fractions was not affected by HF fumigation, but the incorporation of P by the whole-acid soluble nucleotide pool was reduced in corn leaves. In general, there was less apparent effect on the metabolism of acid-soluble nucleotides by HF exposure than has been reported for other metabolic systems of the plants. (Author abstract modified)

3455 APTIC NUMBER 21500

McNulty, I. B. and D. W. Newman
MECHANISM(S) OF FLUORIDE INDUCED CHLOROSIS. Plant Physiol. 36(4):385-388, July 1961. 17 refs.

An investigation was conducted to elucidate the mechanism of action of fluoride-induced chlorosis. Leaf tissue was cultured in a calcium-free mineral nutrient solution, with and without fluoride, under constant light and temperature. Analyses were made on the chlorophylls, photochlorophylls, carotenes, and ether soluble magnesium compounds. Sodium fluoride prevented the accumulation of chlorophyll a, chlorophyll b, and photochlorophyll in bean leaves. However, the photochlorophyll to chlorophyll a transformation was not affected. The chlorphylls, the carotenes, and total ether soluble magnesium containing compounds were all affected proportionately. The similarity in total ether-soluble-magnesium containing compounds indicates there was no inhibiton of pigment synthesis following the attachment of the magnesium atom to the ring structure. These results suggest that the inhibition of pigment synthesis must occur very early in the synthesis of pigment components, or with some phase of basic metabolism necessary for their synthesis. The apparent dissolution of chloroplast structure that occurs concurrently with the appearance of chlorosis could explain the similarity in decrease of all pigments. Thus, fluorides may affect the early stages of pigment synthesis, or induce the degradation of chloroplast structure. (Author summary modified)

3456 APTIC NUMBER 20979

Metcalfe, James, Waldemar Moll, Heinz Bartels, Peter Hilpert, and Julian T. Parer
TRANSFER OF CARBON MONOXIDE AND NITROUS OXIDE IN THE ARTIFICALLY PERFUSED SHEEP PLACENTA. Circulation Res., 16(2):95-101, Feb. 1965. 7 refs.

The sheep placajta sas larfused in situ 'hrough the umbilical circulation with a dextran solution containing carbon monoxide and nitrous oxide in order to provide evidence upon the existence of a countercurrent syste of maternal and fetal blood flow. Carbon monoxide concentration in the perfusion fluid after passage through the umbilical circulation was 19 plus or minus 3% of its concentration in the entering perfusion fluid, representing shunted umbilical flow or the amount which does not exchange substances with the maternal blood. The concentration of nitrous oxide in the perfusion fluid after passing the placental membrane and before admixture of shunted perfusion fluid was 14 plus or minus 4% of its original concentration when the maternal arterial concentration was zero. It is concluded that the perfusion fluid did not at any time reach the maternal arterial concentration and that no functionally effective countercurrent flow pattern exists in the sheep placenta. Reversal of the flow direction in the fetal umbilical vessels resulted in a slight increase of the N20 concentration in the perfusion fluid after passing the placental membrane and before admixture of the shunted perfusion fluid. The placenta is suggested to contain a mixture of countercurrent and concurrent flow units, and diffusion of gases along the capillaries within the comparatively thick placental membrane of the sheep is also considered as a possibility. (Author summary modified)

3457 APTIC NUMBER 21367

Miller, P. Robert, John P. Parmeter, Jr., O. C. Taylor, and P. A. Cardiff
OZONE INJURY TO THE FOLIAGE OF PINUS PONDEROSA. Phytopathology, vol. 53:1072-1076, Sept. 1963. 12 refs.

Needles of ponderosa pine treated with 5 ppm ozone for 9-18 days under field conditions developed a chlorotic mottling, terminal die-back, and abscission similar to the needle symptoms of chlorotic decline. The chlorophyll content of needles treated with 03 for 18 days was less than that of ambient air control. The chlorophyll content of needles treated with filtered air was greater than that of control needles, and the amount of needle abscission was markedly reduced. Continuous air sampling for a 16-day period indicated an average daily peak oxidant concentration of 0.09 ppm. Smog has been associated with plant damage in the nearby San Bernardino Valley. This evidence suggests that the 03 component of photochemical smog may be the principle cause of the chlorotic decline of ponderosa pine in the San Bernardino Mountains. The rapid loss of chlorophyll following exposure to 03 further indicates that the decline results from a reduction in photosynthetic capacity below that necessary to support tree growth. (Author summary modified)

3458 APTIC NUMBER 20908

Miller, P. P., F. W. Cobb, Jr., and P. Zavarin
PHOTOCHEMICAL OXIDANT INJURY AND BARK BEETLE (COLEOPTERA: SCOLYTIDAE) INFESTATION OF PONDEROSA PINE. III. EFFECT OF INJURY UPON OLEORESIN COMPOSITION, PHLOEM CARBOHYDRATES, AND PHLOEM PH. Hilgardia, 39(6):145-160, May 1968. 9 refs.

A study was conducted to determine the effect of atmospheric pollution injury to ponderosa pine on monoterpene and resin acid composition of oleoresin, sugars and reserve carbohydrates of phloem, and phloem pH. A comparison of oleoresin samples from healthy and advanced-diseased trees showed that oxidant injury does

not lead to qualitative changes in the major terpene components or significant changes in the proportion of resin acids. Both soluble sugars and reserve polysaccharides were less in intermediate-diseased and advanced-diseased trees, and lower in both healthy and diseased trees in winter than in summer. However, only the difference in reserve polysaccharides between intermediate- and advanced-diseased trees was statistically significant. The effect of injury on soluble sugars appeared to occur early during symptom development than that on reserve polysaccharides. Phloem pH did not appear to be effected. However, the phloem was not macerated, so the pH, as measured, may not reflect possible changes in cell pH.

3459 APTIC NUMBER 21364

Noble, Wilfred
SMOG. Lasca Leaves, 15(1):1-24, 1965. 20 refs.

The various effects that smog has on plants in the Los Angeles area, and the effects of particular pollutants are discussed. One of the chief characteristics of pollution in this area is its high ozone concentration and the resulting strong oxidizing ability. Some of the components of this pollution has been determined. Peroxyacetyl nitrate (PAN) has been shown to cause silvering, banding, growth reduction, and cellular collapse. Ozone primarily attacks the older leaves and particularly affects woody plants. In contrast to PAN, which attacks the lower leaf surface, ozone affects the palisade layer of the upper surface, causing small clusters of cells to darken and eventually turn brown-black. Only orchids and carnations have shown serious injury due to ethylene. The gas causes dry sepal on orchids. In carnations, the opened blossom reverts back to a bud, and effect called 'sleepiness'. Fluorides are cumulative when absorbed by plants and translocated within the plant, concentrating in the tips and edges of leaves. There they cause a cocoa brown discoloration with well defined borders. Acute injury from sulfur dioxide appears as a tan to white area between the veins, with most severe symptoms appearing on the younger leaves. Presently, not much is known about the effects of nitrogen oxides on plants. After considerable study, it was determined that the only satisfactory means for growing undamaged plants was to filter air through activated carbon. A study of air pollution using plant indicators is also discussed.

3460 APTIC NUMBER 20394

Noble, Wilfred M. and Lloyd A. Wright
AIR POLLUTION WITH RELATION TO AGRONOMIC CROPS: II. A BIO-ASSAY APPROACH TO THE STUDY OF AIR POLLUTION. Agron. J., vol. 50:551-553, 1958. 9 refs.

Poa annua (annual blue grass) was studied and used to determine the relative intensity of the primary phytotoxicant in the Los Angeles smog. Petunia (Rosy Morn) was used in addition in order to increase the reliability of the diagnosis. A standard technique was developed for the use of the two plants. Greenhouse conditions were carefully controlled. Air was filtered through a dust filter and activated carbon. Cooling was accomplished with an evaporative cooler and running water. Air flow was varied. Two temperature ranges were provided. Humidity was maintained at 60%. Plants were grown in vermiculite in plastic cups. They were watered daily with Hoagland's nutrient solution. A week's supply of plants was stored in the filtered side of the compartment. One set of plants were exposed daily for 24 hours in the unfiltered air. At the end of the week, the plants were removed and stored in a small holding house for three days which was equipped with activated-carbon filters to prevent further injury to the plants and also to allow time for any latent damage to develop. Only 1 blade of grass per plant was considered for the purpose of recording and evaluating the degree of injury, although 2 or 3 were damaged. In most instances, the data obtained from plant stations operated in conjuction with other air monitoring stations where oxidant, ozone, and eye irritation were recorded, showed considerable relationship with the latter factors. Plants are normally damaged at concentrations below that necessary to produce eye irritation. However, a higher concentration for a short duration could easily produce irritation without injuring vegetation, since plant damage involves a time concentration factor to a limited extent. There is yet no proof that the toxicant producing these two symptoms is identical.

3461 APTIC NUMBER 20527

Ongun, Alpaslan, W. W. Thomson, and J. B. Mudd
LIPID COMPOSITION OF CHLOROPLASTS ISOLATED BY AQUEOUS AND NONAQUEOUS TECHNIQUES. J. Lipid Res., vol. 9:409-415, 1968. 27 refs.

The use of nonaqueous techniques for obtaining enzymatically active preparations was evaluated by determining the extent to which the composition of glycerolipids is changed during chloroplast isolation in organic solvents. Chloroplasts isolated from tobacco leaves in 0.5 M sucrose solution (the 1000 g pellet) contained 83% of the total cellular monogalactosyl diglyceride, 88% of the digalactosyl diglyceride, 76% of the sulfolipid, and 74% of the phosphatidyl glycerol. Phosphatidyl inositol was concentrated in the 15,000 g pellet. Phosphatidyl choline and phosphatidyl ethanolamine were concentrated in the 15,000 g supernatant fraction. Chloroplasts isolated from tobacco leaves by the nonaqueous method in hexane-carbon tetrachloride showed a glycerolipid composition similar to that of chloroplasts isolated in aqueous media. However, the organic solvents tended to extract monogalactosyl diglyceride. The formation of phosphatidic acid in the fractions isolated by the nonaqueous technique shows that phospholipases are active. If nonaqueously isolated chloroplasts are used for enzyme studies, activation of the phospholipases must be prevented by removing the organic solvent from the isolated pellets before resuspending the latter in aqueous media.

3462 APTIC NUMBER 20933

Ongun, Alpaslan, W. W. Thomson, and J. B. Mudd
LIPID FIXATION DURING PREPARATION OF CHLOROPLASTS FOR ELECTRON MICROSCOPY. J. Lipid Res., vol. 9:416-424, 1968. 17 refs.

Although osmium tetroxide and potassium permanganate are widely

used as fixatives in electron microscopy, there is some controversy concerning the chemistry of their interraction with cellular structures and the amount of lipids fixed. In the present investigation, osmium fixed completely the glycolipids, phosphatidyl glycerol, and phosphatidyl lipids in isolated spinach chloroplasts. However, it fixed only 30% of the chlorophyll. Reaction of potassium permanganate with the spinach chloroplasts fixed more than 90% of the glycolipids, phosphatidyl glycerol, and phosphatidyl choline, provided the reaction period was long enough. Potassium permanganate also fixed the chlorophyll. The fixation of chlorophyll is correlated with the presence of an electron-transparent region in the grana structure of the postassium permanganate-fixed chloroplasts. Reaction of potassium permanganate with isolated C 14-lipids from Chlorella pyrenoidosa fixed 59% and 66% of the radioactivity, respectively. The lipids that were not fixed included sterols and pigments. Electron micrographs show that chloroplasts extracted with chloroform-methanol after fixation in osmium tetroxide or potassium permanganate differ from those dehydrated with acetone. In the former, the osmiophilic globules have been removed and there appears to be some fusion of the boundary layers and grana membranes. These effects may be due to the extraction of unfixed, neutral lipids such as sterols and quinones. (Author abstract modified)

3463 APTIC NUMBER 21293

Przeneck, P.
EFFECTS OF CEMENT KILN DUST PRECIPITATION ON SOILS USED FOR AGRICULTURAL PURPOSES. (Wirkungen von Zementofenstaub-Immissionen auf landwirtschaftlich genutzte Boeden). Text in German. Zement-Kalk-Gips (Wiesbaden), 59(3):119-124, March 1970. 7 refs. (Presented at the meeting of the Committee on Emissions of the Association of the German Cement Industry, Duesseldorf, Feb. 5, 1970.)

It is known today that airborne dusts from cement kilns affect the soil chemically, physically, and biologically through the calcium and potassium content. The quantities of these components vary in dusts from different kilns. Free CaO is converted to carbonate in the soil within a short time. The effect of dusts emitted from cement kilns was studied over a period of six years with five different soils. They ranged from humus-rich to humus-poor soils of clay to sandy composition. In the first two years, red clover was grown, followed by sugar beet, wheat, rye and rape-seed. The dust applied to the soil consisted of 38% CaO and 10% K2O. In the upper 15 cm of all types of soils, an accumulation of lactate soluble potassium was observed. In the sandy soil, more potassium penetrated to lower depth than with the clay types of soil. The presence of calcium raised the pH of the neutral to weakly acid soils and changed the content of active manganese and of water-soluble boron. It became apparent that the processes going on in the soil counteract the effect of the calcium brought into the soil with the cement kiln dusts so that the annually precipitated amounts do not compare in their effect with fertilization. Sugar beet, wheat, and clover which require neutral to alkaline pH grew better in the dust-sprayed soils than in the control soil, while rye reduced its yield.

3464 APTIC NUMBER 20872

Rippel, A
LONG TERM EFFECT OF FLUORIDE EMISSIONS UPON VEGETATION. Fluoride Quarterly, J. Intern. Soc. Fluoride Res., 3(1):18-21, Jan. 1970. 7 refs.

The results are presented of an eight-year study of the fluoride content of fruit, vegetables, and grain grown in four communities near a Czechoslovak aluminum factory. In the community nearest the factory, the fluoride levels in fruit and grain were five and six times higher, respectively, than those of controls. However, the fluoride levels in grain were only 2.6 times as high as in the controls. Root vegetables, especially potatoes, exhibited only minor changes in fluoride content, suggesting that fluoride uptake by plants is independent of fluoride levels in soil. In tuberous vegetables, fluoride accumulated in the portions of the plants growing above ground rather than in the tubers. This fact points to fluoride uptake from the air. The fluoride levels observed after the long-term exposure of plants were above normal. Fruit trees deteriorated progressively, particularly the sensitive plum trees and grape vines. The long-term emissions also distinctly decreased the biological and organoleptic values of the agricultural product and the productivity of agricultural plants.

3465 APTIC NUMBER 21469

Saunders, P. J. W.
EPIDEMIOLOGICAL ASPECTS OF BLACKSPOT DISEASE OF ROSES CAUSED BY DIPLOCARPON ROSAE WOLF. Ann. Appl. Biol. (London), vol. 58:115-122, 1966. 6 refs.

Diplocarpon rosae, which causes the blackspot disease of roses, is predominantly a water-distributed fungus with a limited range of dispersal. The high incidence of the disease among commercial and private roses is the result of close-grown monocrop cultures, which also encourage the rapid spread of the disease. Under conditions of very high humidity, as often occur in well-sheltered rose beds, blackspot can reach epiphytotic proportions. The disease follows a logarithmic pattern of development during the growing season. This development depends on the triggering of accumulated inocula in late summer by heavy rainfall coincidental with an average daily temperature above 14 C. In south-west England, August is the period in which preventive measures will give the greatest control. The incubation period of this major dispersal phase is two to four weeks in duration, the resultant infection becoming visible in September. It then accumulates at a uniform rate until the end of the growing season.

3466 APTIC NUMBER 20476

Schoenbeck, Helfried
A METHOD FOR DETERMINING THE BIOLOGICAL EFFECTS OF AIR POLLUTION BY TRANSPLANTED LICHENS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(1):17-21, Jan. 1969. 21 refs.

A method for transplanting the leaf lichen Parmelia physodes for use as an indicator of various air pollutants is described. This type of lichen is relatively indifferent to its base; its natural ecological conditions can be disregarded for at least six months, and the medium into which the lichen and its substrate are transplanted has little significance over an even longer period. The method entails removing the lichen from the tree (preferably oak), transplanting it into exposure boards of wood or other material, exposing the lichen in the area being investigated at a height of 1.5 m, recording withering effects (manifested by color changes) photographically, and grading the intensity of damage. The method is expected to simplify and reduce costs of certain air quality measurements, especially for sulfur dioxide and fluorine emissions, and also indicate changes in air quality due to such conditions as wind direction.

3467 APTIC NUMBER 21422

Schoenbuck, H., M. Buck, H. van Haut, and G. Scholl
BIOLOGIC AIR POLLUTION MEASUREMENT METHODS. (Biologische Messverfahren fuer Luftverunreinigungen). Text in German. VDI (Ver. Deut. Ingr.) Ber., no. 149:225-238, 1970. 49 refs.

Plants can be used as indicators for air pollution. Test plants grown under comparable conditions in various distances from the emission source help to detect not only the type of pollutant causing injuries but also the effect of dust sediments in the soil. This method used in the vicinity of a zinc smelting plant revealed that sulfur, zinc, and lead containing emissions caused the observed plant injuries. Lolium multiflorum and L. perenne growth in synthetic pots and set up at various distances from a fluorine emitting plant provided indication of the quantities emitted at each point. Transportable plexiglass chambers can be used as covers for the plants at greatly different climatic conditions among the various exposure sites. Filtered and unfiltered air is drawn into the chambers. Apart from higher plants, lower epiphytic organisms such as lichens or moss can be used as indicators for air pollution. The widely spread parmelia physodes can be transplanted onto carrier plates and exposed. A clear relationship between the growth rate of these lichens and the SO2 and HF concentration of the ambient air could be found.

3468 APTIC NUMBER 21098

Schonbeck
INVESTIGATION OF THE SUITABILITY OF LICHENS AS INDICATORS OF AIR CONTAMINATION. (Pruzkum vhodnosti lisejniku jako indikatoru znecisteni vzduchu). Scientific and Technical Society, Prague (Czechoslovakia), Agriculture and Forestry Section, Proc. Conf. Effect Emissions Forestry, Janske Lazne, Czechoslovakia 1966, 7p. Oct. 11-14.) Translated from Czechoslovakian. Franklin Inst. Research Labs, Philadelphia, Pa., Science Info. Services. April 24, 1969.

The suitability of lichens as indicators of urban air pollution was demonstrated by transplanting the lichen Parmelia physodes to the trunks of the oak Quercus sessiliflora in 10 localities in the Ruhr. Different types of emissions of various concentrations were observed to cause different degrees of decay in the lichens. Similarly, lichens transplanted to a region of iron roasting sheds found to decay after exposure to the sulfur dioxide emitted by roasting operations.

3469 APTIC NUMBER 21189

Shikenjo, Norinsho Sanshi
AIR POLLUTION AND SERICULTURE. (Taikiosen to yosan-sogo shoroku). Text in Japanese. Sanshi Shikensho Shiryo (J. Sericultural Experiment Station), no. 20:102p., April 1966. 518 refs.

Various types of sericulture damage by atmospheric pollutants are considered in terms of responsible sources, in addition to the effects of the pollutants on mulberry leaves and silk worms. Damages are classified as follows: (1) sericulture damage due to gaseous, solid, and liquid wastes, the major contaminants of which are sulfur dioxide, hydrogen fluoride gas, chlorine gas, smoke dusts, and aerosols; (2) damage due to stack smokes generated by charcoal burning, heavy-oil burning, the skyrocket type of fireworks, and rubber-tire burning; (3) damage due to motor vehicle exhaust gas, dust clouds, mud, and mire; (4) damage due to aerially sprayed agricultural chemicals; (5) damage due to irradiated substances; (6) damage due to volcanic ashes; (7) damage due to salt-containing sea wind; (8) and damage due to hazardous substances, such as nicotine, contained in tobacco plants cultivated on adjacent farms or to other hazardous plants and crops such as pyrethrum, Picrasima quassioides Benn, bindweed, and peppermint. A bibliography is provided in which references are classified according to specific sources and their respective effects on both mulberry trees and silkworms.

3471 APTIC NUMBER 20690

Shupe, James L.
FLUORINE TOXICOSIS AND INDUSTRY. Am. Ind. Hyg. Assoc. J., 31(2):240-247, March-April 1970. 10 refs.

Fluorosis in livestock can be accurately diagnosed and controlled when the complexity of the disease is realized, and the symptomatology, pathogenesis, and lesions are properly correlated, interpreted, and evaluated. Tooth classification and the amount of fluorine in bone can be used to diagnose and evaluate the degree of fluorosis with a high degree of accuracy. Some products can counteract and lessen the potential damage that ingested fluorides can cause. Aluminum sulfate, aluminum chloride, calcium aluminate, calcium carbonate, and defluorinated phosphate can reduce the toxicity of fluorine in animals. Multiple correlation formulas useful in diagnosing fluorosis, and livestock fluorine tolerances are included in tabular form. A comprehensive guide is also presented which facilitates diagnosing and evaluating fluorosis. (Author conclusion modified)

3471 APTIC NUMBER 21076

Smith, Richard F. and Wallace H. Fuller
IDENTIFICATION AND MODE OF ACTION OF A COMPONENT OF POSITIVELY-IONIZED AIR CAUSING ENHANCED GROWTH IN PLANTS. Plant Physiol., 36(6):747-751, 1961. 22 refs. (Presented at the 37th regional AAAS Meeting, Tempe, Ariz., April 17, 1961.)

Exposure of Sicrocoleus vaginatus to positively-ionized air results in increased migration and growth. Negative ions show no observable effect. The increased-growth, dependent on the presence of positively-ionized carbon dioxide, can be duplicated by adding minute amounts of indoleacetic acid. Positive air ions caused a slight but significant increase in the growth of oat coleoptiles, and released added indoleacetic acid from corn coleoptiles. Negative air ions had no significant effect. The hypothesis is advanced that positively-ionized air causes increased growth in plants by releasing endogenous bound indoleacetic acid. (Author summary modified)

3472 APTIC NUMBER 21062

Sobocky, F.
PRELIMINARY RESULTS OF ECONOMIC AND SYLVICULTURAL MEASURES AGAINST THE EFFECTS OF FLUORINE IN THE REGION OF ZIAR N.HRONOM. (Predbezne vysledky lesnickohospodarskych opatreni proti pusobeni fluoru v oblasti Ziaru n.Hronom). Scientific and Technical Society, Prague (Czechoslovakia), Agriculture and Forestry Section, Proc. Conf. Effect Ind. Emissions Forestry, Janske Lazne, Czechoslovakia, 1966, 10 refs. (Oct. 11-14.) Translated from Czech. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, p. VIII-1 to VIII-13. April 24, 1969.

Results of research and sylvicultural and economic measures taken to reduce the harmful effects of emissions in the area of Ziar N.Hronom were summarized. The source of the emissions was a metallurgical plant producing aluminum. The sylvicultural measures were first directed toward the most severely attacked zone I of the area, and on non-sylvan areas, which were not used to grow trees, located within the reach of the maximum smoke attack between the forest boundary and the plant. In zone I, practically all degrees of injury were found, starting with depigmentation and necrosis formation in assimilation organs, up to the loss of foliage and decay of conifers. From among four-year plants on unforested land, which were subjected to various cultivation operations including mineral fertilization, best results were obtained for black alder, birch, red oak, pedunculate oak, and Austrian pine. Fertilization with lime and ground Thomas slag proved efficient only in the case of black alder. A much better result was provided by hoeing and mowing. Successful foresting depends not only on exposure to the emitting source, but also on a lower HF concentration. Terrian relief creates a natural barrier to penetrating emissions. The beech stand, situated 2110 m eastward of the emitting source, reduced the detrimental effect of HF in its above surface layer by approximately 30% in comparison to a free area in front of the stand boundary. A ten-year pine culture, 1950 m south-southeast from the source, reduced the harmful effect of HF by approximately 50% by comparison to total clearing, and thus fulfilled the protective function by being in front of the sheltered trees.

3473 APTIC NUMBER 20982

Spaleny, J.
EFFECT OF FLUE DUST FROM POWER STATIONS ON GERMINATION AND PHOTOSYNTHESIS OF HIGHER PLANTS. (Vliv elektrarenskych popilku na kliceni a fotosyntezu vyssich rostlin.) Scientific and Technical Society, Prague (Czechoslovakia), Agriculture and Forestry Section, Proc. Conf. Effect Ind. Emissions Forestry, Janske Lazne, Czechoslovakia, 1966, p. XXI-1 and XXI-12. (Oct. 11-14.) Translated from Czech. Franklin Inst. Research Labs., Philadelphia, Pa. Science Info. Services. April 24, 1969.

Experiments were conducted to test the inhibitory effects of certain constituents of power plant dusts on the metabolism of plants. Dust samples provided a total spectrum of the sizes of dust particles. Feeding cabbage was used as the model plant because of its comparatively intensive photosynthetic activity. Germination was realized in Petri dishes located in a thermostat at the temperature of 20 C and exposed to illumination of 700 lux. Illumination lasted for 8 hrs and occurred every 24 hrs. The water layer in the individual dishes was high enough to cover the seeds without blocking sufficient air access. Acid flue dust (pH 4.3) significantly inhibited both germination and growth. Less acid flue dust (pH 5.3) had no influence, and neutral flue dust (pH 6.4) exerted a positive effect. Results showed that dusting of the upper side of the leaf exerts more influence on the inhibition of photosynthesis than dusting on the lower side of the leaf. This is mostly due to the fact that more flue dust will adhere to the upper side, and both the choking of vents and the light screening from the flue dust layer will be evidenced on the surface of the leaf. Results showed that the soluble component of flue dust also inhibits photosynthesis. Flue dust made wet by water mist is a less active inhibitor of photosynthesis. In a microscopic comparison of dry and wet flue dust, accumulation of dust particles occurs which evidently leads to some dechoking of certain vents, and the dust screen acting against the incident light will be partially decomposed.

3474 APTIC NUMBER 20537

Stark, R. W., P. R. Miller, F. W. Cobb, Jr., D. L. Wood, and J. R. Parmeter, Jr.
PHOTOCHEMICAL OXIDANT INJURY AND BARK BEETLE (COLEOPTERA: SCOLYTIDAE) INFESTATION OF PONDEROSA PINE. I. INCIDENCE OF BARK BEETLE INFESTATION IN INJURED TREES. Hilgardia, 39(6):121-126, May 1969. 3 refs.

A total of 107 beetle-killed and 936 nearest-neighbor ponderosa pines were examined to determine the association between severity of atmospheric pollution injury and infestation by bark beetles. Trees exhibiting chlorotic decline due to pollution injury were most frequently attacked by the western pine beetle Dendroctonus brevicomis and the mountain pine beetle D. ponderosae. The degree of injury and incidence of bark beetle infestation were not

related to total height, diameter, length of live and dead crown, or crown class. As severity of oxidant injury increased, live crown ratio decreased and incidence of bark beetle infestation increased. One hundred noninfested trees in three disease categories (advanced, intermediate, or healthy) were examined for evidence of prior beetle attacks. Thirty-six percent of the advanced-diseased trees vs only 5% of the healthy trees were attacked. Thus, beetles may discriminate between healthy and diseased trees at a distance, upon contact with the host, or both. These studies strongly indicate that atmospheric pollution injury predisposes ponderosa pine to bark beetle infestations. (Author abstract modified)

3475 APTIC NUMBER 21095

Sumida, S. and J. R. Mudd
BIOSYNTHESIS OF CYTIDINE DIPHOSPHATE DIGLYCERIDE BY CAULIFLOWER MITOCHONDRIA. Plant Physiol., 43(7):1162-1168, July 1968. 6 refs.

Pathways of lipid synthesis by way of cytidine diphosphate diglyceride in plants are similar to the pathways found in other organisms. Cauliflower inflorescence was homogenized with a 0.5 molar sucrose and 0.01 molar tris-hydrogen chloride solution pH7.5, and centrifuged. Chloroform and aqueous layers were separated from a reaction mixture containing the enzyme source in the sucrose-tris medium, magnesium chloride, and cytidine triphosphate-carbon 14. An aliquot from the chloroform layer was placed in a scintillation counter, while the aqueous fractions were chromatographed. Incorporation of radioactivity into lipid is shown as a function of time, and it is apparent that the ability to utilize CTP in the formation of lipid soluble compound is mainly located in the mitochondria. The lipid soluble product of carbon 14-CTP incubation with cauliflower mitochondria was compared with the reference CDP-diglyceride in 3 different chromatographic systems. Products of the guinea pig liver microsomal biosynthetic system and the cauliflower mitochondrial system chromatographed as a single spot with an Rf of 0.08; and co-chromatography was found also in the next two systems. Experiments indicate that the CTP is being degraded by a phosphate, and that radioactive inositol and alpha-glycerophosphate are incorporated into lipid by mitochondrial preparations from cauliflower.

3476 APTIC NUMBER 20270

Takehara, H. and T. Sato
RELATION BETWEEN AIR POLLUTION AND SULFUR CONTENTS IN PINUS DENSIFLORA NEEDLES IN TOKYO AREA. (Tokyo tonai no taikiosen to akamatsu no yochuiwoganyuryo to no kankei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):134, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The detection of damage to trees due to air pollution is difficult because the symptoms are not readily apparent. Thus, it is more convenient to use an element such as sulfur contained in the leaves as the index of air pollution and the future tree population. In the period 1967-68, Japanese red pines were investigated at nine polluted locations in Tokyo and two non-polluted outlying places. The sulfur content of the needles was measured according to the age of needles and the season of the year. Using the lead dioxide method to indicate the degree of air pollution, the red pines do not exist in areas where the index is over 1.0; even in the 0.5 - 1.0 area, they are scarce and the population is deteriorating. The statistical analysis shows that the sulfur content of 1.79 (milligram sulfur per gram of leaf) for the first-year needles and 2.58 for the second-year needles would be appropriate indexes of air pollution damage.

3477 APTIC NUMBER 20572

Taylor, O. C., F. B. Stephens, F. F. Darley, and E. A. Cardiff
EFFECT OF AIR-BORNE OXIDANTS ON LEAVES OF PINTO BEAN AND PETUNIA. Proc. Am. Soc. Hort. Sci., vol. 75:835-844, 1960. 10 refs.

Experiments were conducted in reaction chambers and in ambient air to compare the characteristics of leaf injury on petunia and pinto bean plants in the presence of 0.1 to 0.5 concentrations of ozone; the reaction products of ozone and 1-hexene, irradiated nitrogen dioxide and 1-hexene, and oxidants in polluted ambient air. Ozone caused (1) chlorosis at dosages of less than 0.2 ppm with long exposure and mesophyll collapse at dosages more than 0.25 ppm on the oldest petunia leaves, and (2) mesophyll collapse on 14-day-old pinto bean leaves, and to a lesser extent, on 7-day-old bean leaves. Reaction products of ozone and 1-hexene caused no visible injury on petunia leaves but did produce glazing of the under surface and mesophyll collapse on 14-day-old pinto bean leaves. Photochemical reaction products of nitrogen dioxide and 1-hexene caused (1) banding and lower surface glazing of young, expanding petunia leaves; (2) bronzing and glazing of lower surface of 7-day-old primary and trifoliate pinto bean leaves, and (3) no injury of 14-day-old pinto bean leaves. Oxidants in polluted ambient air maximum concentration of about 0.3 ppm caused ozone and ozone-hexene types of injury on pinto bean plants, but the injury most prevalent on the bean and petunia plants appeared to be identical with that caused by the irradiated mixtures. (Author abstract modified)

3478 APTIC NUMBER 20579

Taylor, O. C., E. A. Cardiff, J. D. Mersereau, and J. T. Middleton
EFFECT OF AIR-BORNE REACTION PRODUCTS OF OZONE AND 1-N-HEXENE VAPOR (SYNTHETIC SMOG) ON GROWTH OF AVOCADO SEEDLINGS. Proc. Am. Soc. Hort. Sci., vol. 71:320-325, 1958. 10 refs.

Zutano avocado seedlings were fumigated with the reaction products of ozone and 1-N-hexene vapor (synthetic smog) for 280 hours over a period of eight weeks to determine the effect on growth. Fumigation with this synthetic smog reduced stem elongation 56%; leaf width, 35%; leaf length, 35%; trunk diameter, 21%; fresh weight of seedlings (including the root system), 52%; and dry weight of seedlings (including the root system), 58%. A characteristic brown discoloration was observed on the lower surface of young expanding leaves after about 70 hours exposure

to the synthetic smog. Marginal and tip necrosis of leaves of all ages occurred on some of the fumigated avocado seedlings. No leaf injury was observed on avocado seedlings grown in clean air. It is hypothesized that the growth suppression observed may have been due to a deficiency of available synthesized carbohydrates, possibly as a result of increased respiration, rather than to direct toxicity to meristematic tissue. (Author summary modified)

3479 APTIC NUMBER 21686

Taylor, O. Clifton and David C. MacLean
NITROGEN OXIDES AND THE PEROXYACYL NITRATES. In: Recognition of Air Pollution Injury to Vegetation: A Pictorial Atlas. Jay S. Jacobson and A. Clyde Hill (eds.), Pittsburgh, Pa., Air Pollution Control Assoc., 1970, p. E1-E14. 23 refs.

The effects of nitrogen oxides and peroxyacyl nitrate (PAN) on vegetation are discussed. The susceptibility of some plants to nitrogen dioxide- induced is shown in tabular form. Continuous exposure of pinto bean and tomato plants for 10-22 days to 0.5 ppm NO2 suppressed growth without attendant foliar lesions. Acute foliar markings produced by high-concentration NO2 exposures are characterized by water-soaked lesions in the upper leaf surface, followed by rapid tissue collapse. Gradually, these lesions extend through the leaf and produce small necrotic patches. External factors reported to affect plant sensitivity to NO2 include soil moisture, light, and relative humidity. No visible symptoms of leaf injury from nitric oxide have been reported. It is thought that NO may cause growth suppression without detectable leaf symptoms. Young plants are more susceptible to PAN than older plants of the same species. Peroxypropionyl nitrate (PPN) is several times more toxic than PAN, and peroxybutyl nitrate (PBN) is more toxic than PPN, but no differences in injury symptoms produced by the three compounds have been noted. PAN injury develops on three or four rapidly expanding leaves of a sensitive species. Injury appears at the apex of the youngest leaf, as a diffuse band across the intermediate-aged leaf, and at the base of the oldest leaf. Total collapse and necrosis of sensitive leaf tissue occurs when susceptible plants are exposed to high concentration. Incipient chlorosis develops and the injured area becomes flaccid.

3480 APTIC NUMBER 21093

Thompson, C. R.
EFFECTS OF AIR POLLUTANTS ON LEMONS AND NAVEL ORANGES. Calif. Agr., 22(9):2-3, 1968.

Lemon trees were divided into 6 groups of four, and each group received an experimental treatment of an atmospheric phytotoxicant previous to water use determination. Activated carbon filters removed ozone and peroxyacyl nitrates, both components of photochemical smog; limestone removed acid fluoride gases, such as hydrogen fluoride; and nitric oxide reacted to remove ozone. Levels of total oxidants, fluoride, and temperatures in the air were recorded continuously. Trees receiving filtered air required more extra irrigation than those with ambient air, and trees receiving filtered air and filtered air plus fluoride had a higher rate of apparent photosynthesis than those receiving ambient air. Preliminary evaluation indicates that trees which get ambient air have an increased leaf drop (up to 40%) and yield less fruit than trees which receive carbon-filtered air.

3481 APTIC NUMBER 21501

Threshow, Michael, Gerald Dean, and Frances M. Harner
STIMULATION OF TOBACCO MOSAIC VIRUS-INDUCED LESIONS ON BEAN BY FLUORIDE. Phytopathology, vol. (57):756-758, July 1967. 9 refs.

The possible effect of fluoride on the number of local lesions developing on Pinto bean leaves following inoculation with tobacco mosaic virus was studied. Plants were grown in fumigation chambers where atmospheric fluoride concentrations ranged from 0.2 to 2.5 micrograms/ cu m; foliar fluoride concentrations ranged from 20 to 637 ppm. The number of lesions increased with foliar fluoride concentrations up to 500 ppm, above which the number decreased. Lesion numbers on plants in the unfumigated chambers served as a control, and these values represented 100%. The lesion numbers on leaves with fluoride concentration of 100-200, 200-300, 300-500 ppm were 121%, 157%, and 179%, respectively. When lesion numbers were grouped according to leaf age, lesions were most prevalent on the first trifoliolate leaves. The number of lesions decreased on older leaves and plants. When leaves were fully developed and plants had reached the four- to five-leaf stage, no lesions could be induced. (Author abstract modified)

3482 APTIC NUMBER 21081

Tollinger, V.
CRITERIA FOR EVALUATION OF THE RATE OF INJURY OF FOREST TREES WHICH ARE UNDER CONSTANT EXPOSURE TO INDUSTRIAL EMISSIONS. (Kriteria pro posouzeni miry poskozeni lesnich porostu chronicky poskozovanych prumyslovymi exhalacemi). Scientific and Technical Society, Prague (Czechoslovakia), Agriculture and Forestry Section, Proc. Conf. Effect Ind. Emissions Forestry, Janske Lazne, Czechoslovakia, 1966, p. XX-1 to XX-14. 3 refs. (Oct. 11-14.) Translated from Czech. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 17p., April 1969.

A method is developed mathematically to express dynamic long-term injury to whole groves as trees, as opposed to present static methods of describing injuries to organs of individual trees. Injuries to groves by gaseous emissions can be characterized, according to this method, by rate of injury, derived from the relationship between performed (random) processing of tree reserves and the processing prescription (permissible processing). Results can eventually indicate the percent of reduced growth increment, and, to some degree, the future course of injury. The method was verified by application to the forest farm Janov, located in Krusne hory. It was found that random processing of spruce trees had greatly exceeded permissible processing; the structure of random processing shows a continuing increase in the proportion of processed dry

woods. Injury to the grove has reached the point where the existence of the entire forest in the region of the Krusne hory ridge is threatened, and because of increasing industrial emissions, is likely to increase. Results from this method of determining the rate of injury of older trees correlated with findings of investigators using other approaches. (Author summary modified)

3483 APTIC NUMBER 21687

Treshow, Michael and Merrill R. Pack
FLUORIDE. In: Recognition of Air Pollution Injury to Vegetation: A Pictorial Atlas. Jay S. Jacobson and A. Clyde Hill (eds.), Pittsburgh, Pa., Air Pollution Control Assoc., 1970, p. D1-D17. 29 refs.

The damaging effects of fluoride on plant foliage, flowers, and fruits are discussed. Fluoride injury results from the gradual accumulation of fluroide in the plant tissue over a period of time. Therefore, the duration and the atmospheric concentrations are important in determining the severity of injury. Different plant species, varieties or clones of a single variety, and plants from different seed lots differ in their susceptibility to fluoride. A list of some common plant species, which are sensitive to fluoride, is presented in tabular form. The characteristic symptom of fluoride injury on many broad-leaved plants is necrosis, which occurs primarily at the leaf tips and margins where the fluoride has accumulated. This symptom is seen in apricot, gladiolus, European grape, and conifers. Fluoride sometimes causes a distinctive injury symptom in lilacs. A reddish-purple discoloration develops along the leaf margins and extends into a mottled reddish pattern between the veins. More severe injury results in chlorosis and necrosis. Fluoride also causes chlorosis in citrus, popular, sweet cherry, and corn. Fluoride injury results in marginal necrosis of the petals and sepals of flowers, and in soft suture in some fruits.

3484 APTIC NUMBER 21503

Webster, George C.
THE EFFECT OF CARBON MONOXIDE ON RESPIRATION IN HIGHER PLANTS. Plant Physiol., vol. 29:399-400, 1954. 5 refs.

The widespread distribution of cytochrome oxidase in most of the tissues of higher plants has raised the possibility of its general participation in plant respiration in a manner similar to that in animals, yeast, and aerobic bacteria. Carbon monoxide inhibiton of cytochrome oxidase activity is eliminated by light, while the carbon monoxide inhibition of tyrosinase is insensitive to light, providing a means to differentiate between the activities of these oxidases in plant respiration. The respiration of root (1 cm sections) or other tissue (0.5 mm slices) in 0.05 M potassium phosphate buffer (pH 7.1) was measured at 25 C by standard manometric techniques in various ratios of carbon monoxide or nitrogen to oxygen, and results are reported for 95% CO and 5% O2. Respiration of all eleven tissues studied was strongly inhibited by carbon monoxide, and in ten of the eleven cases examined, the inhibition was largely or completely eliminated by irradiation of the tissue with light. Despite the results with apple fruit tissue, which has consistently failed to show any reversal of CO inhibiton, the general importance of cytochrome oxidase in plant respiration is indicated.

3485 APTIC NUMBER 21497

Went, F. W.
GLOBAL ASPECTS OF AIR POLLUTION AS CHECKED BY DAMAGE TO VEGETATION. Stanford Research Inst., South Pasadena, Calif., Proc. Nat'l Air Pollution Symp., 3rd, Pasadena, Calif., 1955, p. 9-11.

The effects of smog on vegetation and its global distribution are discussed. Smog on leaves of spinach, endive, tobacco, and petunia causes a silvering of the lower surface, except in severe cases when it also extends to the upper surface. This silvering is quite specific for smog and persists throughout the life of the leaf. Since usually the young, recently matured leaves are most sensitive to smog damage, it is possible to judge when a particular plant was damaged by noticing the age of the leaves. Thus, a cumulative picture of smog occurrence over a period of a month is available where older petunia and tobacco plants are found. No smog damage to plants was observed in rural areas more than 50 miles from metropolitan areas, except in Los Angeles and London. In most cities, the existence of a clear-cut type of smog damage could be established. In addition to large populations, much metropolitan traffic, the proper topgraphy, and meteorology are needed to find smog damage. The relationship between plant damage and gasoline consumption is demonstrated by a survey of London, Paris, and Los Angeles; as soon as consumption reached a value of 12 tons/sq mile/day, plant damage appeared. Theories are presented on the formation of haze and photooxiiation.

3486 APTIC NUMBER 20265

Yamasaki, M. and K. Nishiyama
COMPARATIVE RESISTANCE TO SMOKE INJURY BETWEEN TREES DERIVED FROM WARM AND COLD REGIONS. (Odan chiiki to kanreichiikio kigen to suro jumokukan no engaiteikosei no hikaku). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):133, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The relationship between the intensity of resistance to smoke and the place of origin of the trees are investigated. A variety of trees known to populate either the warmer or the colder region of Japan was subjected to an experiment whereby small branches with leaves were treated with 0.05% potassium chlorate solution. Potassium chlorate and smoke (especially sulfur dioxide gas) have earlier been found to arouse antitoxic mechanism similar in nature and intensity. The trees originating in the warmer region tended to show higher resistance to smoke damage (indicated by their reaction to potassium chlorate), and those from colder climate tended to be lower in resistance. This was true even within the same species, and coniferous trees in general were higher in resistance than deciduous trees.

1967 APTIC NUMBER 21173

Yarwood, C. E. and John T. Middleton
SMOG INJURY AND RUST INFECTION. Plant Physiol., vol. 29:394-395, 1954. 9 refs.

Bean and sunflower leaves infected with rust (Uromyces phaseoli or Puccinia helianthi) were less injured by natural or artificial smog than were otherwise similar, healthy leaves. To produce the same degree of smog, or ozonated olefin, damage on bean tissue which has been infected with rust for 7 days required about five times as long an exposure to smog as to produce the same injury in healthy tissues. Rusted tissue in which the rust mycelium was killed by heat was still resistant to smog damage. The protection from smog damage by rust infection could not be explained by stomatal closure or by the high content of pantothenic acid in the rust infected tissue, but appears to be due to some substance which diffuses beyond the limits of the rust mycelium. (Author summary)

1968 APTIC NUMBER 20981

Zelinka, Rudolf
SMOKE-CAUSED DAMAGE IN UPPER AUSTRIA, ESPECIALLY IN THE LENZING AREA. (Kourove skody v Hornim Rakousku zvlaste v okoli Lenzingu). Scientific and Technical Society Prague Czechoslovakia Agriculture and Forestry Section, Proc. Conf. Effect Ind. Emissions Forestry, Janske Lazne, Czechoslovakia, 1966, p. V-1 to V-9. (Oct. 11-14.) Translated from Czech. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, April 24, 1969.

A brief historical review of smoke damage to forestry caused by several large factories in Upper Austria and measures being currently taken are given. Spruce, fir, and pine are particularly sensitive to smoke. The area in which the forests are attacked by smoke amounts to about 1,850 ha in Upper Austria. A compensation chart was constructed according to the degree of damage. The losses were assessed empirically in terms of the growth increment from results of research conducted by experts from factories causing the smoke damage on a scientific basis. As a result, the heavy attacks of sulfur dioxide were reduced in 1965 to about one third of the value of previous years. Deciduous trees were planted; attention was given to the cultivation of spruces and white pines that will be comparatively resistant to exhaust gases from industrial plants. The grafting technique was adopted; various mineral fertilizers were used. The costs pertaining to the conversion of stands, means of protection against gnawing by wildlife, maintaining of the cultures, and measures against the bark-boring beetle were fully covered by the factories.

3489 APTIC NUMBER 20464

Baines, Frank
AN EXAMINATION INTO THE EFFECTS OF ATMOSPHERIC POLLUTION ON BUILDING STONES ETC. WITH A PRELIMINARY SUMMARY OF THE CONDITIONS DISCLOSED BY VARIOUS ENQUIRIES INTO THE STATE OF THE ATMOSPHERE OF GREAT BRITAIN. Manchester, National Smoke Abatement Society, 1933, 36p. (Presented to the National Smoke Abatement Society at a Meeting held in London, July 14, 1933.)

The air pollution problems in England are reviewed since the year 1273 and up to and including the year 1932, which is concerned almost exclusively with emissions from coal-burning industrial and domestic heating plants and in particular, with smoke and sulfur dioxide. The topics covered include parliamentary action, actions by municipalities and other local authorities, notable scientific investigators of the 'smoke' problem, coordination of all local air-pollution observations, pertinent research by the Department of Scientific and Industrial Research since 1927, complaints about air pollution by power stations, coal statistic, population statistics, rough estimates of impurities, results of air-pollution measurements, and effects of pollutants on human health and on vegetation. The effect of atmospheric pollution on buildings is also discussed. The principle agents are sulfur oxides from combustion of sulfur-bearing coal, which combines with dew, rain, frost, snow, fog, etc. in the form of sulfuric acid. Building stones most widely used in England are sedimentary stones such as calcitic limestones, and magnesium limestones are the most subject to disintegration.

3490 APTIC NUMBER 20421

Brenner, Raymond C, Richard Hooker, K. K. Stevens, Carlton Strong, and E. M. Lee
PAPERS ON THE EFFECT OF SMOKE ON BUILDING MATERIALS. Pittsburgh Univ., Pa., Mellon Inst. of Industrial Research and School of Specific Industries, Bull. No. 6, 1913, 58p. 7 refs.

Not until the general public is awakened from its apathy will the smoke nusiance, the greates blot on our industrial centers, be eliminated. Data has been accumulated for the following topics: chemistry of soot and the corrosive products of combustion; effect of smoke on outside painting; effect of smoke on paint coatings; effect of smoke on stone; stone and the smoke nuisance with special reference to the protection of stone; effect of smoke on metals; the question of light and smoke; the effect of smoke on the interior of buildings; and limitations placed by smoke upon the means of architectural expression. This monograph addressed to the general public presents the facts about air pollution by combustion products of bituminous coal as they were known in the year 1912. The papers on the effect of smoke on paint coatings are based on work done for the National Paint Manufacturers' Association. The last three papers describe the effects of covering of skylight windows, lighting fixtures, wall paper, painted interior walls, lace curtains, silk hangings, floor coverings, etc. etc. by soot, In general, the simplest possible form of architecture is to be advised. Under-cutting, delicacy of incised line and sharpness of angular forms must be forgone, for the soot deposited will, in time, fill up the crevices and mar the beauty of the outline, causing considerable alteration of the original forms and make the building degenerate into a mere mass of dirty, shabbey masonry.

3491 APTIC NUMBER 21487

THE WEATHERING, PRESERVATION AND MAINTENANCE OF NATURAL STONE MASONRY (PART I). Building Research Station Digest, 20:1-8, July 1950.

Stone building materials with a high content of carbonates are most susceptible to attack by air pollutants, although the more porous types of stone are subject to the deposition of salts, regardless of chemical composition. Soot and sulfur dioxide are the principal air pollution factors that affect stone. The film of calcium sulfate which forms over limestone is more detrimental than helpful to the inner material, often leading to a spontaneous blistering and scaling of the surface. Limestone containing magnesium is subject to the formation of magnesium sulfate, an extremely aggressive material. Limestone surfaces have been effectively maintained, even in a heavily polluted atmosphere, by periodic washing (e.g., every six months). Ornamental stone should be protected from the influence of the soil by the use of damp-proof courses. Buildings located near salt water are subject to contamination by chlorides.

3492 APTIC NUMBER 21467

Hudson, J. C. and J. F. Stanners
THE EFFECT OF CLIMATE AND ATMOSPHERIC POLLUTION ON CORROSION. J. Appl. Chem. (London), vol. 3:86-96, Feb. 1953. 3 refs.

The results up to 20 annual corrosion tests of small reference specimens of ingot iron and of zinc, at each of more than 20 sites in various parts of the world, are given. In Great Britain, where for most of the year the climate is sufficiently humid to promote corrosion, the degree of sulfur pollution of the air determines the severity of corrosion. Almost perfect correlation was found between the amount of SO2 measured by lead peroxide gauges and the rate of corrosion, both for steel and zinc. Reasons are discussed for the observation that as sulfur pollution increases, the ratio of the corrosion of iron to that of zinc in the same atmosphere decreases; this ratio is lowest in the most corrosive atmospheres, with some exceptions. In the absence of sulfur pollution, corrosion is slight, while in a dry climate it is negligible. Due to salt spray, corrosion on surf beaches in the tropics may be exceptionally severe. Distance from the ground appears secondary to the natural variations in corrosion from one year to another. Some details of experimental technique are discussed. It was confirmed that at low copper contents, variations of a few hundredths of 1% in copper content have a marked effect on the corrosion-resistance of ingot iron; therefore recent tests have been made instead on specimens of copper-steel. Failure to stir Clarke's solution when derusting ingot iron or copper-steel does not affect the efficiency of the derusting process.

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3493 APTIC NUMBER 21432

McCoy, J. D. and F. B. Hagel
NEW CORROSION RATE DATA FOR HYDRODESULFURIZING UNITS. Hydrocarbon Process., 49(6):116-120, June 1970. 10 refs. (Presented to the API Division of Refining, Houston, Tex., May 13-15, 1970.)

The effect of hydrodesulfurizing process variables on high-temperature corrosion rates of chrome-moly and austenitic stainless steels were evaluated using gaseous mixtures of hydrogen-hydrogen sulfide. Test conditions included concentrations of 0.03-10.6 vol% hydrogen sulfide; temperatures of 600, 800, and 900 F; and pressures from 100-2000 psig. Corrosion rate data was obtained at time intervals up to 2500 hrs. Of the three variables studied, temperature was the only one having a significant effect on corrosion rates above 1.0 mole H2S. A uniform rate of corrosion did not occur until after 300 hrs of exposure and the formation of a tight adhering iron-chromium sulfide film. From this rate data, curves were constructed which show expected long-term corrosion rates vs temperature. Certain gas-metal sulfidation rates were a fractional order function with respect to time. An Arrhenius plot of these fractional order reaction rate constants is included. (Author introduction modified)

3494 APTIC NUMBER 21473

Moraru, D. and I. Timar
ATMOSPHERIC AGGRESSION TOWARD CONSTRUCTION MATERIALS ALONG THE BLACK SEA COAST OF RUMANIA AND ITS CLASSIFICATION BY ZONES. (Agresivitatea atmosferica asupra constructiilor de pe litoralul romanesc al Marii Negre si zonarea ei). Text in Romanian. Revista Constructiilor si a Materialelor de Constructii, 20(10):527-535, 1968. 1 ref.

Atmospheric salinity, influenced by the salt content of the Black Sea is measured and studied; the area up to 20 kilometers from the coast is divided into zones, on the basis of the need for protection of certain building materials (metals and concrete) affected by the atmospheric salinity.

3495 APTIC NUMBER 20507

Pepper, Leonard
INFLUENCE OF ALKALI CONTENT OF FLY ASH ON EFFECTIVENESS IN PREVENTING EXPANSION OF CONCRETE. Army Engineer Waterways Experiment Station, Vicksburg, Miss., TR-6-627, 26p., June 1963. 6 refs.
CFSTI, DDC: AD 687367

Eight mixtures containing various ratios of high- or low-alkali fly ash and cement, and two control mixtures were made to determine the influence of the alkali content of fly ash on its effectiveness in preventing expansion of concrete due to alkali-aggregate reaction. Mortar bars made from the mixtures were cast and their lengths measured at 2, 14, and 28 days, 6 months, and 1 year. Data from this and a previous investigation using a medium-alkali fly ash indicated that the approximate minimum percentage replacements of portland cement needed to reduce expansion of mortars made with high-alkali cement and very reactive aggregate by 75% at 14 days for the low-, medium-, and high-alkali fly ash are 11, 46, and 47%, respectively. Although the high-alkali fly ash will increase the expansion of an inocuous combination, the expansion will not be so great as to render the resulting mixture deleterious. The data from the mortar-bar expansion test were too variable, both within and between batches, for the test to be used in research on aggregate reactions in concrete. Results of this investigation did not confirm conclusions from an earlier study, and indicate the need for further research. (Author abstract modified)

3496 APTIC NUMBER 21584

Vernon, W. H. J.
ATMOSPHERIC CORROSION AS RELATED TO ATMOSPHERIC POLLUTION. In: The Investigation of Atmospheric Pollution. Rept. 19, p. 48-49, 1933. 11 refs.

Minute amounts of atmospheric pollution frequently play an important part in the corrosion of metal structures and are sometimes represented by preponderating amounts of sulfates or basic sulfates in the final products. The patina on the copper spire of N. Mimms Church, set in the midst of open country in Hertfordshire, contains 81.5% basic copper sulfate. Arising from the presence of lead in the metal, a double basic sulfate of lead and copper enters into the deposit to the extent of 6.1%, so that the total of metallic basic sulfate amounts to 87.6%. The residue is made up partly by wind-borne material, and partly by basic copper carbonate, 2.8%. In the town, the proportion of basic carbonate is much higher, as for example 25.0 and 22.8% on the roof of the London Museum and the dome of the British Museum Library. The green deposit consists essentially of basic copper chloride at the sea-board, due to the influence of wind-borne chlorides; but where urban and marine conditions coincide, basic sulfate greatly predominates over basic chloride. The formulae to be ascribed to these basic salts are related to period of exposure, maximum basicity being reached only after about 70 years when basic copper sulfate has the 'co-ordination formula' $CuSO_4.3Cu(OH)_2$. Initially-formed sulfates, instead of passing into insoluble and adherent basic salts, readily hydrolyze to give ferric hydroxide or rust in the atmospheric corrosion of iron. In atmospheres containing the usual small concentration of sulfur dioxide, a certain critical humidity is necessary for appreciable corrosion to occur; above this critical value (commonly about 65%), rate of attack may increase enormously. Traces of hydrogen sulfide constitute the initiating atmospheric factor in the tarnishing phenomenon, but here again a definite relationship has been established between the reactive sulfur content of the atmosphere and rate of tarnishing.

ECONOMIC ASPECTS

3497 APTIC NUMBER 21354

Arnold, Thomas M. and Cecil H. Chilton
NEW INDEX SHOWS PLANT COST TRENDS. Chem. Eng., 70(1-3):143-152, Feb. 10, 1963. 22 refs.

A cost index for chemical plant construction is presented. All labor and wage or earning rates are continuously adjusted for trends in worker productivity. Cost of engineering and supervision manpower for design and construction is included. No extraneous items are priced or weighted into the index. All index components are based on the 1957-1959 period, and index data goes back through 1947. Indexes are reported for four major components (equipment and machinery; erection and installation labor; buildings, materials, and labor; engineering and supervision manpower) along with an over-all Plant Cost Index. Index objectives are to furnish the engineer who does capital cost estimating with a new over-all cost index for complete process plants as well as to provide indexes for the major components of such plants; to include as complete a list of realistic components in the over-all index as possible; and to construct an index that accurately and sensitively reflects the true cost trends of plants built in the process industries. Various charts and tables are included to illustrate important points.

3498 APTIC NUMBER 21574

COMPARING COSTS OF MATERIALS FOR CRYOGENIC CONTAINERS. Chem. Eng., vol. 70:134, 138, Nov. 25, 1963.

Cost comparison charts are presented for finished, fabricated cryogenic containers. In estimating costs, a hypothetical fabricating shop was assumed which employed welders capable of semi-automatic welding of stainless steel, the 5000 series aluminum alloys, 9% nickel steel, and 3 1/2% nickel steel. Shop fabrication and fabrication in the field are considered; the shop-fabricated vessels are assumed to be cylindrical and the field-erected vessels to be spherical or cylindrical. The charts show that 3 1/2% nickel steel is the most economical material considered, although it is limited to applications down to -175 F. For applications below -175 F, aluminum is competitive with 9% nickel steel in shop-fabricated vessels to about 50 psia. Above 50 psia, 9% nickel seems to be less expensive. Stainless steel is competitive with aluminum in small containers and in the 150-200 psia range, and above 250 psia, it is economically preferable over aluminum. Among cylindrical field-erected vessels, aluminum containers are competitive with 9% nickel steel up to 20,000 bbl, but they are more expensive above this capacity. For spherical field-erected containers of 6000-bbl capacity, 9% nickel and aluminum are competetive at low pressures; 9% nickel is less expensive above 10 psig.

3499 APTIC NUMBER 21178

DuToit, P. S. J.

THE FUNCTIONAL RELATIONSHIP BETWEEN DUST HAZARD AND THE RATE OF COLLECTING FUNDS TO PAY COMPENSATION FOR PNEUMOCONIOSIS. J. S. African Inst. Mining Met., 70(8):291-309, March 1970. 38 refs.

The problem of basing the current rate at which money is collected from mine owners to pay compensation for pneumoconiosis in the future on the current dust hazard in mines is evaluated. The authorities are faced with finding the functional relationship between dust and pneumoconiosis and between pneumoconiosis and compensation. The certification of pneumoconiotics and the incidence of pneumoconiosis are discussed against the background of existing legal provisions for collecting funds of compensation. The various pneumoconiosis indices are considered. In the data analyzed, the only pneumoconiosis index common to a number of classes of mines is the time it takes to develop pneumoconiosis. Sets of dust indices and pneumoconiosis indices are computed. Expressions are derived for the time it takes to develop pneumoconiosis as a function of the dust hazard, and for the collection of funds as a function of the time available for collection. From these two expressions follows the rate of collection of funds as a function of the dust hazard. A clear connection exists between current dust index and current levy index, so that if the amount of the annual compensation which has to be paid is to be apportioned among mine owners, the levy index can be calculated precisely in a way which meets the spirit of the legislation, namely that money is to be collected today from owners of mines to compensate, in the future, for damage done today.

3500 APTIC NUMBER 21221

Pels, M. and H. L. Crawford
FEASIBILITY STUDY OF CENTRALIZED AIR-POLLUTION ABATEMENT. (FINAL REPORT). Battelle Memorial Inst., Columbus, Ohio, Columbus Labs., NAPCA Contract PH-86-68-84, TAsk 12, 51p., Nov. 17, 1969. 35 refs.
CFSTI: PB 190486

The technical and economic aspects of a centralized air-pollution control plant located a distance from seven industrial plants were investigated. The plants chosen were as follows: lime, 200 tons/day; cement, 4500 barrels/day; sulfuric acid, 400 ton/day; power, 25 Mw; fertilizer, 570 tons/day; gray iron, 1440 tons/day; and electric arc, 2600 tons/day. Gaseous- and particulate-emission levels were taken from literature sources, and as far as possible, average values were used for each industry. The total amount of gases from the plants was 627,000 cfm at 320 F and after mixing. While the centralized control facility is less expensive to build and operate than individual control devices, transportation costs are so high as to make the centralized concept unattractive. The economics would favor centralized abatement only if each of the seven plants were located at about 1/2 mile from the central facility. This distance is considered to be unrealistically close from the standpoint of an individual plant's land requirements. In addition to transportation costs, the centralized plant would render emissions from lime, cement, and sulfuric acid plants valueless, and any equipment malfunction would release large quantities of pollutants over a relatively small area. Finally, vegetation growth over buried pipes would be inhibited, leading to potential esthetic problems. (Author summary modified)

3501 APTIC NUMBER 21308

Ferguson, F. A., K. T. Semrau, and D. R. Monti
SO2 FROM SMELTERS: BY-PRODUCT MARKETS A POWERFUL LURE. Environ. Sci. Technol., 4(7):562-568, July 1970.

The non-ferrous smelting industries currently recover less than one quarter of the sulfur in the ores treated by the 26 smelters west of the Mississippi. The rest, almost 1.6 million long tons of sulfur a year, is being emitted as sulfur oxides. Pollution control could be advanced significantly if smelters could make and market any of the following by-products: elemental sulfur, sulfuric acid, liquid sulfur dioxide, and ammonium sulfate (or bisulfite). The results of an analysis of the potential market are reported. The total market for liquid sulfur dioxide in the western United States is so small that no market or production data was developed. The 1970 cost of producin elemental sulfur at the smelter (45-100 dollars per ton) provides little opportunity to complete with Frasch mine produced products at 10-30 dollars. Sulfuric acid with its smelter-produced cost of 4-25 dollars per ton can complete as long as transportation costs are held to a minimum. This requires that the market be within a few hundred miles of the smelter. Even with this stipulation, the total market including potential growth through 1975 could absorb only 80% of the potentially producible sulfuric acid. Emission reductions of 60-65% could be obtained. Together with the current and potential market for ammonium sulfate, an emission reduction of 65-70% is possible.

3502 APTIC NUMBER 21241

Vogel, M. F., D. R. Johnston, R. L. Collins, D. A. LeSourd, R. W. Gerstle, and P. L. Hill
COMPREHENSIVE ECONOMIC COST STUDY OF AIR POLLUTION CONTROL COSTS FOR SELECTED INDUSTRIES AND SELECTED REGIONS. (FINAL REPORT). Research Triangle Inst., Durham, N. C., Operations Research and Economics Div., NAPCA Contract CPA 22-69-79, RTI Proj. OU-455, 414p., Feb. 1970. 360 refs.
CFSTI: PB 191054

Costs are estimated for controlling emissions of particulates, sulfur oxides, hydrocarbons, and carbon monoxides from twenty-two sources within 100 metropolitan areas, through the fiscal period 1970-1975; data defining relevant processes and air pollution control engineering characteristics required to support the analyses are presented. Sources for which control cost estimates were made are solid waste disposal, steam-electric generating plants, industrial boilers, commercial and institutional heating plants, residential heating plants, and the following industrial categories: kraft pulp, iron and steel, gray iron foundry, primary and secondary nonferrous metallurgy, sulfuric acid, phosphate fertilizer, petroleum refining, cement, lime, coal cleaning, petroleum products and storage, grain milling and handling, varnish, and rubber tires. The total investment cost includes $221 million, $1.29 billion, and $1.13 billion to control emissions from solid waste disposal, stationary combustion, and industrial process sources, respectively, while the metropolitan areas for which cost estimates are the highest include the very large, highly industrialized, more northern cities of Chicago, New York, Pittsburgh, Philadelphia, Cleveland, Detroit, and St. Louis. Assuming the 1967 emissions as a baseline, calculations are performed to determine the pollutant removal efficiencies required to bring the emissions into compliance with the standards assumed. (Author abstract modified)

3503 APTIC NUMBER 20402

Hale, Dean
FORTY SIX MILLION DOLLARS IN LNG PROJECTS UNDERWAY. Am. Gas J., 193(10):30-32, Aug. 1966. 2 refs.

Capital investments for existing or proposed U. S. LNG (liquefied natural gas) projects are examined. Operational projects include: Wisconsin Natural Gas Co. (Oak Creek), San Diego Gas and Electric Co. (South Bay), Alabama Gas Co. (Birmingham), and Transco (Carlstadt, N. J.). Projects under construction are: Brooklyn Union Gas Co. (Greenpoint Works), Memphis Light, Gas, and Water Div., Tennessee Gas Pipeline (Hopkinton, Mass.), Philadelphia Gas Works, and Texas Eastern (Staten Island). Some details are given regarding the Philadelphia Gas Works, Brooklyn Union Gas, Tennessee Gas, and Texas Eastern facilities. The operational characteristics are presented with respect to purification liquefaction, and storage.

3504 APTIC NUMBER 20401

Martin, Richard
NEW LNG TANKER IS STEP TOWARD ECONOMIC WORLDWIDE GAS MARKET. Am. Gas J., 193(7):41-43, June 1966.

The French LNG (liquefied natural gas) tanker Pythagore is described. This is the first such vessel to use the so-called self-supporting integrated or membrane tank, fabricated from 1-mm thick corrugated steel plates. These membrane tanks have a capacity of 300 cu m but can be scaled-up to 5000 cu m; they promise important space, construction cost, and operating cost savings. Pumping, reliquefaction, and safety equipment are also briefly described. The economic significance of Pythagore to the development of a worldwide gas market is stressed.

3505 APTIC NUMBER 20536

McClanahan, Roger R.
MORE MONEY FOR POLLUTION CONTROL. Conf. Board Record, 5(9):26-29, Sept. 1968. 3 refs.

Two-hundred and one companies in 16 industries were surveyed and found to have increased their capital expenditures for pollution control from $397 million in 1967 to $547 million in 1968. In addition, the companies will spend over $71 million for antipollution research and engineering in 1968 as against $30 million in 1967. Textile mills reported the largest increase (up to 800%) in control expenditures. Rises exceeding 250% are indicated for wood products, scientific and controlling instruments, and electrical machinery. Producers of fabricated

metal products, rubber, and plastics are more than doubling their outlays. Only aircraft and parts and food products show decreased expenditure. Almost two-thirds of the total 1968 budget is allocated to water pollution. Industries that have earmarked considerably more for water pollution include fabricated metals, scientific and controlling equipment, food products, and nonelectrical machinery. For firms engaged in primary iron and steel, chemicals, and petroleum refining, expenditures are more evenly divided between air and water control. Companies making stone, clay, and glass products, electrical machinery, and aircraft and parts will devote the major part of their abatement expenses to air pollution.

3506 APTIC NUMBER 21547

Mills, Herbert E.
COSTS OF PROCESS EQUIPMENT. Chem. Eng., vol. 71:133-156, March 16, 1964.

A comprehensive compilation of equipment cost data for estimating expenditures for process plants is presented. Pertinent information concerning each item, obtained from an average of vendors' quotations are presented in charts and tables. Included are many items commonly used to make order-of-magnitude or preliminary chemical plant cost estimates. Coverage includes items relating to manufacturing equipment, fabrication, piping, instrumentation, power and electrical, building and construction, and yard improvements. The items are defined as to purchase cost, capacity, horsepower, size, and materials of constuction to avoid chance of error in interpretation and application. Reasonable installation time is given to avoid guesswork in determining total estimated cost. All data are based on a Marshall and Stevens index of 238.8. (Author abstract modified)

3507 APTIC NUMBER 21486

Nelson, W. L.
TANKER TRANSPORTATION COSTS. PART I. WHO OPERATES THE TANKER FLEET? Oil Gas J., 66(23):104-105, June 3, 1968. 11 refs. PART II. Ibid., 66(24):113, June 10, 1968. 17 refs. PART III. Ibid., 66(26):100-101, June 24, 1968. 24 refs.

The first part of this three-part article on crude-oil tanker transportation costs discusses the kinds of tanker operators. Long-term charters constitute about half of the tanker fleet; companies (and governments), about 40%; and single-fixtures or spot charters operated by independents, about 10%. Single fixtures (or spot rates) are presented for 1967 and the average of spot rates during 36 months (1964-1967) are shown. The cost of long-term charters is used as 7% less than the 36-month average and spot rates are used for single fixtures. Part two presents break-even costs or rates as a function of tanker size. Break-even costs raised by 18.5% are considered to be the cost of operating company (and government-owned) vessels. The profit is much less than 18.5% because the break-even cost for company-operated vessels is larger than the average break-even cost (and especially so for government-operated vessels). These proportions of vessels and costs form the basis of equations of transportation costs presented in part three.

3508 APTIC NUMBER 21553

CHEAP STORAGE OF LNG ASSURED. Oil Gas J., vol. 60:66-67, July 2, 1962.

The successful testing of an underground concrete tank (1000 bbl) for liquefied natural gas storage means that investment costs for a liquefaction, storage, and regasification plant project can be reduced 25-30%. Based on the demonstration tank, the following estimates were obtained for large concrete tanks: $2 per Mcf for a 100,000-bbl tank; $1.50 per Mcf for a 200,000-bbl tank; $1.15 per Mcf for a 285,000-bbl tank; and $1 per Mcf for a 450,000-bbl tank. Another storage approach may be as much as 15% cheaper than the underground-concrete method. In this method, liquefied methane is stored in an unlined earthen pit and the pit is frozen to form an impermeable barrier to the liquid.

3509 APTIC NUMBER 21424

Rentz, Otto
THE PROBLEM OF AN ECONOMIC SELECTION OF DUST EXTRACTORS. (Zum Problem der wirtschftlichen Auswahl von Entstaubern). Text in German. Wasser Luft Betrieb, 14(5):194-198, May 1970. 35 refs.

In order to find the most economic dust collector, a cost comparison must be carried out. The following costs must be included in the comparative calculation: depreciation, capital costs, energy costs, maintenance costs, costs for scrubbing fluids, costs for chemicals, space costs, insurance and real estate taxes, and salaries. Generally it can be said that dust collection systems with high investment costs have a low energy consumption (electrostatic precipitators) and systems with low investment costs a high energy consumption. It is advisable to determine the total costs in dollar/year and not per cu m gas cleaned, since the gas volume is dependent on the cleaning method. This type of cost comparison has the disadvantage that the investment costs are distributed over the life-span of the system. It does not show the temporal distribution of the expenditures. Cost accounting (determine the profit of a project per unit of invested capital) as well as the calculation of amortization are not applicable unless the dust emission source is included in the calculation.

3510 APTIC NUMBER 21300

INVESTIGATIONS OF THE IHK DUISBURG: IN NORDRHEIN WESTFALEN 2300 MILLIONS OF DEUTSCHE MARK HAVE BEEN EXPENDED FOR AIR POLLUTION CONTROL. (Untersuchung der IHK Duisburg: In Nordrhein-Westfalen wurden 2,3 Milliarden DM fuer die Luftreinhaltung aufgewandt).

Text in German. Wasser Luft Betrieb, 13(10):387-388, Oct. 1969.

North-Rhine Westphalia spent 2.3 billion German Marks (.575 billion dollars) in the period between 1955 and 1968 in an effort to maintain clean air. Industries increased expenditures for air pollution control from 23.9% in 1964/65 to 27.1% in 1969. Research costs in the field declined from 8.6 million German Marks (2.15 million dollars) to 7 million German Marks (1.75 million dollars) per year. This is due to the fact that several research projects have been completed: the problem of brown smoke has been solved and the study of sulfur dioxide removal has been completed with the development of the so-called 'double contact process'. The iron and steel industry has made the major investment in air pollution control, followed by the chemical industry. The money went primarily into improving existing air pollution control systems.

3511 APTIC NUMBER 20966

Wolozin, Harold
THE THEORY AND PRACTICE OF SETTING CRITERIA FOR PUBLIC EXPENDITURES-A SUGGESTIVE SURVEY. American Univ., Washington, D. C., 44p., 1963 (?). 51 refs.

Certain aspects of the current state of the economics of public expenditure criteria, such as its tools, its scope, and its limitations, are explored. The problem and its setting is outlined. The economic theory which is invoked for decision making in the public sector of the economy, i.e., the public household, is discussed. In order for the economist to exert his technical skills, he must make certain assumptions on the nature of the environment. The public sector skills are grouped under the general heading of benefit-cost analysis. In applying the theory of public expenditure criteria to the special problems of air pollution control, problems arise which stem from the limitations of the theory itself. Planning under constraints; welfare economics-the economist's tool box; welfare economics and the individual firm or consumer; benefit-cost analysis and public expenditure; and benefit-cost analysis and water pollution are covered. It is concluded that the treatment of social and merit needs as uniquely the province of public policy, as well as the distinction made between them, can serve as a realistic basis for facing up to the problem of air pollution control, specifically the increased obligation of public authorities at all levels of government. Economic criteria must be integrated with the social, economic, and psychological factors which are part of the total problem of air pollution control.

3512 APTIC NUMBER 20684

American Industrial Hygiene Assoc., Detroit, Mich., Aerosol Technology Committee
GUIDE FOR RESPIRABLE MASS SAMPLING. Am. Ind. Hyg. Assoc. J., 31(2):133-137, March-April 1970. 28 refs.

The most satisfactory 'respirable' mass sampling instruments and procedures are reviewed. Two criteria which have been specified for 'respirable' dust measurement are the British Medical Research Council's (BMRC), and that adopted at the 1961 Los Alamos conference sponsored by the U. S. Atomic Energy Commission's Office of Health and Safety. The BMRC criterion is met by certain stacked, parallel plate, horizontal elutriator-type size separators. The Los Alamos criterion is based on dust deposition studies. The purpose of both criteria is based on approximate dust deposition in the non-ciliated portions of the lung. Several of the available size-selector devices for use with 'respirable' mass dust limits are described. Dust passing a size selector must be analyzed for mass or a mass related variable. Filters to be weighed must be of a type for which weight does not change for humidity. Filters satisfying this criterion include glass fiber, silver membrane, and polyvinyl chloride membrane. Because of the possibility of re-entrainment of particles collected of the first sampling stage, it is recommended that the sampling cyclone or elutriator be cleaned at regular intervals. Since the cyclone and horizontal elutriator collection efficiency is dependent upon sampling flow rate, this parameter should be monitored, and laboratory calibrations conducted at regular intervals.

3513 APTIC NUMBER 21016

Hashimoto, M. and T. Oshio
CONTROL PLANNING OF AIR POLLUTION OF SULFUR OXIDES. (Iwosankabutsu ni yoru taikiosen no boshikeikaku). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):75, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969)

Pursuant to the Air Pollution Control Law passed in December 1968 with respect to areas with excessive sulfur pollution, a special emission standard regarding sulfur dioxide was proposed. Some of the basic criteria relevant to the establishment of such a control standard can be described as follows: the establishment of an intermediate emission standard following the determination of the projection period; the measurement of the present level of pollution; the expansion rate of the sulfur dioxide concentration and the forecasting of sulfur dioxide pollution; and the conditions surrounding the smoke emission sources. For the environmental quality standard, for example, the allowable intermediate value over a span of five years would be 0.25 - 0.3 ppm for areas with a concentration over 0.3 ppm, and 0.2 ppm for areas less polluted, measured at 99% levels.

3514 APTIC NUMBER 20335

Hashimoto, Michio
ENVIRONMENT STANDARDS AND MEASURES FOR PUBLIC HAZARDS CONTROL. (Kankyo kijun to Kogai taisaku). Text in Japanese. Anzen Kogaku (J. Japan Soc. Safety Eng.), 8(5):251-256, Sept. 15, 1969.

Environmental standards aim at controlling artificial environmental conditions along with natural conditions. Such standards are based on the premise that every individual is exposed to various complicated environmental conditions 24 hours a day and for many years. Moreover, they cite the possible influence of the environment on animals and plants. Japan's environmental standard is based on articles of the fundamental law which was established in 1967 to prevent public nuisances. Formulation of the standard was contingent on scientific and technological studies of the influence of various environment conditions on human beings. The most up-to-date science and technology must be applied to the selection of the criteria by which the environmental conditions, as well as their influence, can be easily judged. The environmental standard is employed to control the volume of waste material and exhaust gas, to regulate the usage of land and industrial sites with respect to public health and natural conditions, and to determine the extent of pollution. The standard has not yet resolved such problems as the air pollution in Yokkaichi city and methyl mercury poisoning.

3515 APTIC NUMBER 21140

Horvath, Helmuth
A SIMPLE METHOD FOR MEASURING THE EFFICIENCY OF DUST COLLECTORS FOR EACH SEPARATION STAGE. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(11):29-32, Nov. 1969. 4 refs.

The feasibility of using a seven-stage cascade impactor (Andersen sampler) to measure the efficiency of a wet scrubber was evaluated in tests of aerosols similar to incinerator aerosols in concentration, chemical composition, and size distribution. The use of fractionating instruments leads to a simple and rapid method for determining the properties of dust separators, since small particles need not be counted or measured. If separation proceeds in several stages, the particles are classified according to their aerodynamic behavior and the amount of dust precipitated is determined by weighing. The test does not require the use of a standard aerosol. In the case of wet dust separation, the test aerosol should have approximately the same affinity to liquid as the particles to be separated. The data obtained in this manner enable calculations of the total separation efficiency for any aerosol whose size distribution is known. (Author conclusions modified)

3516 APTIC NUMBER 20893

Hughes, R. T. and J. M. Ives
HYDROCARBONS IN AIR STANDARDS. National Bureau Standards, Washington, D. C., Microchemical Analysis Section, TN-505 p. 11, Oct. 1969.

A series of methane in air standards containing approximately 1, 10, 100, and 1000 ppm methane were prepared and analyzed. The analyses of the standards was performed by using a flame ionization detector to compare the response from the standard to the response from two calibration standards. A calibration standard in the hundred ppm range was compounded by stepwise dilution of methane with air of known low hydrocarbon content, with concentrations determined from the weights of the components

with a precision analytical balance. Using this standard and hydrocarbon-free air obtained by passing air through cupric oxide at 1050 C, a calibration standard containing about 2 ppm hydrocarbon was prepared. This standard was analyzed by the flame ionization method. The concentrations of the standard reference gases obtained from the pressures of the components during compounding and the concentration determined with the flame ionization detector agree within 1%.

3517 APTIC NUMBER 20894

Hughes, E. E. and J. M. Ives
STANDARD REFERENCE MATERIALS. 1. SULFUR DIOXIDE IN AIR. National Bureau of Standards, Washington, D. C., Microchemical Analysis Section, TN-505, p. 9-11, Oct. 1969.

Because mild steel and stainless steel containers are not suitable for storing dilute concentrations of sulfur dioxide and air, a new method of preparing SO2 mixtures was attempted. A single high concentration (0.2 mole%) was prepared in a large (1%) cylinder and the mixture was then transferred to 20 small (2 l) cylinders. A mass spectrometric comparison of the gas in the small cylinders with that in the large cylinder involved admitting a sufficiently high pressure of the mixture to the inlet system so that the mass 64 due to SO2 could be read to better than 1%. The ion current due to nitrogen in air at mass 28 was brought within readable limits by adjusting the input resistor of the pre-amplifier and scanning the mass 28 at lower sensitivity than the 64. While not sufficiently absolute for final certification of the concentration, the method is adequate for comparison of one concentration of SO2 with another. Preliminary work on a method of preparing low concentrations of SO2 in an air stream is also described. The procedure depends on the effusion of SO2 from a porous plastic tube containing liquid SO2 and the determination of the evolved SO2 by titration of the sulfuric acid formed. Measuring effusion by titration appears to be promising.

3518 APTIC NUMBER 21084

Izmerov, N. F.
ATMOSPHERIC AIR POLLUTION WITH GASOLINE VAPOR AND ITS LIMIT OF ALLOWABLE CONCENTRATION. In: Limits of Allowable Concentrations of Atmospheric Pollutants. V. A. Ryazanov (ed.), Book 5, Washington, D. C., U. S. Public Health Service, March 1962, p. 52-67. 17 refs. (Translated by B. S. Levine.)

The effects of solvent gasoline vapors emitted from crude oil on conditioned reflex reactions, odor thresholds, and eye sensitivity were studied. White rats exposed to 106.5 cu m vapor concentration 6 hours daily for 5 months showed shifts in conditioned reflex activity which progressed with exposure duration, but which returned to normal two weeks after the exposure was terminated. No notable changes occurred in the cerebro-cortical activity of rats exposed to a chronic inhalation of 21.8 mg/cu m or in the control rats. Thresholds of odor perception were 10 mg/cu m for solvent gasoline; 6.5 for automotive gasoline; and 7.5 cu m for aviation gasoline. Solvent gasoline vapor began to affect reflex activity at 56 mg/cu m concentration; the threshold of reflex activity effect proved a sensitive index for determining maximum allowable concentrations. It is recommended that 5 mg/cu m of low-sulfur gasoline vapor be adopted as the MAC cu m in atmospheric air, calculated in terms of hydrocarbons. Industrial enterprises which use gasoline in ton quantities per day constitute potent sources of ambient air pollution with gasoline vapor (hydrocarbons). Sanitary clearance zones around such plants must be not less than 500 m wide. Results of air sample test analyses showed that gasoline vapor concentrations in the air 30 m from an auto repair shop were as high as 7.1 mg/cu m. It was recommended that the zone surrounding that shop be not less than 50 m. Plants which use gasoline as solvent in 2.5 ton quantities per day should have a clearance zone of not less than 300 m, and plants using up to 1.5 tons per day, 100 m wide. (Author conclusions modified)

3519 APTIC NUMBER 21133

Kurnosov, V. N.
BASIC DATA FOR THE HYGIENIC DETERMINATION OF LIMITS OF ALLOWABLE MERCURY VAPOR CONCENTRATION IN ATOMSPHERIC AIR. In: Limits of Allowable Concentrations of Atmospheric Pollutants. V. A. Ryazanov (ed.), Book 5, Washington, D. C., U. S. Public Health Service, March 1962, p. 39-51. 22 refs. (Translated by B. S. Levine.)

Experiments on the effects of mercury inhalation by rats are described, and previous investigations of mercury toxicity are reviewed. Also included is a summary of symptoms of mercury poisoning on humans under industrial conditions. The major sources of atmospheric mercury vapor emissions are plants producing mercury and plants which use it as a raw or supplemental material, such as chemical and pharmaceutical industries and factories producing light bulbs. It is also used in large quantities in the substations of certain electric transportation systems. Experimental exposure of animals to 2-5 micrograms/cu m of mercury vapor, a level frequently occurring in the atmospheric air around industrial enterprises, produced such changes in the higher nervous activity as functional disturbances in the brain cortex and diffuse protective inhibition. Concentrations of 0.3 micrograms/cu m elicited no changes; therefore the present 0.3 allowable limit of mercury concentration in atmospheric air is considered valid until more thorough studies prove otherwise. It was found that 10 micrograms/cu m of mercury in the air of working premises can cause chronic poisoning and that 8-10 and 2-5 micrograms/cu m used experimentally elicited notable functional changes in the higher centers of the nervous system. Therefore, it is recommended that the present occupational MAC of 10 micrograms/cu m be reduced. (Author conclusions modified)

3520 APTIC NUMBER 20560

Larsen, Ralph I.
RELATING AIR POLLUTANT EFFECTS TO CONCENTRATION AND CONTROL. National Air Pollution Control Administration, Durham, N. C., Office of Criteria and Standards, 43p., 1969(?). 31 refs.

Examples are cited relating air pollutant effects to concentration and control. The examples are organized under a dozen possible steps that could be used to proceed from air quality criteria to clean air. The purpose is to offer assistance to State, regional, and local air managers and their air management boards in deriving the air quality standards and emission standards needed to prevent various unwanted pollutant effects. Numerous tables and statistics are given. The air pollution problem from the common combustion pollutants is similar in both large and small cities. If 95% emission reduction were needed for nitrogen oxides control in a city of 1,000,000, then indications are that 90% reduction would be needed to achieve the same air quality standard in a city of only 1000. If similar emission standards were used in both large and small cities, the citizens of the small cities would enjoy slightly cleaner air with fewer of the objectionable air pollution effects. Tables are presented for concentrations of carbon monoxide, hydrocarbons, nitric oxide, nitrogen dioxide, oxidants, and sulfur dioxide at various urban locations. The relationships between air polution and excess mortality particularly with SO2 and plant damage are discussed.

3521 APTIC NUMBER 20546

Letavet, A. A. and A. I. Korbakova
INDUSTRIAL TOXICOLOGY AND THE PREVENTION OF OCCUPATIONAL POISONINGS IN THE CHEMICAL INDUSTRY. Zh. Vses. Khim. Obshchestva im. D. I. Mendeleeva, 12(3):242-253, 1967. 24 refs. Translated from Russian, 22p.

The rapid development of the chemical industry and the introduction of many new chemicals are posing the problem of assuring working conditions under which the possibility of occupational poisoning would be excluded. Continuous automatic recording of the air in production areas is recommended to detect the presence of toxic substances. In investigations of the toxicity of new chemicals methods of determination are being developed to monitor their content in the air and determine the effective concentrations. Information from experimental investigations makes it possible to recommend maximum allowable concentrations (MAC values) of chemicals in the air of production areas. MAC values, like other hygienic standards, are regarded as an important factor in the technical process. A comparison is made between the MAC values established by the USSR and those established by the U. S. Several methods of reducing the toxicity of different chemicals are presented, and the effect of various chemicals on the different systems of the body are discussed.

3522 APTIC NUMBER 20702

THRESHOLD LIMIT VALUES OF AIRBORNE CONTAMINANTS ADOPTED BY ACGIH FOR 1969 AND INTENDED CHANGES. Med. Bull., 30(1):70-88, March 1970. 1 ref.

Threshold limit values refer to airborne concentrations of substances, and represent conditions under which nearly all workers may be repeatedly exposed without adverse effects. Simple tests are available that detect those individuals supersusceptible to a variety of industrial chemicals. Threshold limit values refer to time-weighted concentrations for a 7 or 8 hour day and 40 hour week. They should be used as guides in the control of occupational health hazards. The time-weighted average concentration is inappropriate for substances which are fast acting and whose threshold limit is more appropriately based on this particular response. These substances can be controlled by a ceiling 'C' limit that should not be exceeded. Some listed substances are followed by the designation 'Skin'. This is intended to suggest appropriate measures for the prevention of cutaneous absorption. There may be some accumulation of insoluble substances in the respiratory passageways. In the case of soluble substances, this accumulation will be temporary, but may interfere with respiratory processes. A threshold limit value of 15 mg/ cu m, or 50 mppcf, of total dust less than 1% SiO2, whichever is smaller, is recommended for these substances. It is recognized that such physical factors as heat, ultraviolet and ionizing radiation, humidity, and abnormal pressure may place added strain on the body so that the effects from exposure at a threshold limit may be altered. In such cases, judgement must be exercised in the proper adjustements of the threshold limit values.

3523 APTIC NUMBER 21017

Ministry of Health and Welfare, Tokyo (Japan)
ON THE ENVIRONMENTAL STANDARDS CONCERNING SULFUR OXIDES. (Iwo-sankabutsu ni kakawaru kankyokijun ni tsuite). Text in Japanese. 3p., Feb. 1969. (Decision of the Cabinet meeting of the Ministry of Health and Welfare, Feb. 2, 1969.)

Environmental standards are determined for sulfur oxides harmful to health. The fulfillment of the standard is especially directed to three types of areas: the heavily polluted area, for which ten years is set as the projected time period; the areas presently being developed, requiring five years; and the areas presently under consideration for industrial development, requiring prevention as the basic measure. The fundamental measures to be taken toward the promotion of air pollution control are the pursuit of low-sulfur fuels, development of sulfur elimination methods and devices, development of appropriate pollution control measures for each area aside from the areas described above, assistance to regional public and private organizations, appropriate land use, strengthening of emission standards, and proper organization of monitoring.

3524 APTIC NUMBER 21083

Shatskanyan, A. V.
BASIC EXPERIMENTAL INFORMATION FOR THE DETERMINATION OF THE LIMIT OF ALLOWABLE CHLOROPRENE CONCENTRATION IN ATMOSPHERIC AIR. In: Limits of Allowable Concentrations of Atmospheric Pollutants. V. A. Ryazanov (ed.), Book 5, Washington, D. C., U. S. Public Health Service, March 1962, p. 79-85. 13 refs. (Translated by P. S. Levine.)

Studies were made of the physiological effects of chloroprene, a highly volatile fluid emitted with other unsaturated and chlorine-substituted hydrocarbons emitted during the synthesis of rubber from acetylene. Results obtained by question and answer indicated that 0.9 mg/cu m is the threshold concentration of chloroprene odor perception for the average persons, and 0.4 for persons with sensitive odor perception. Threshold

concentrations on the functional state of the visual analyzer, determined by use of an adaptometer, coincided with threshold values determined by the odor perception method. Threshold and subthreshold chloroprene vapor concentrations increased the analyzer sensitivity to light stimulation; concentrations 8 or more times greater than threshold values reduced the sensitivity. It is recommended that the maximum allowable concentration be set at 0.25 mg/cu m. Concentrations of chloroprene found in the atmospheric air surrounding a synthetic acetylene rubber plant greatly exceeded the threshold concentrations; reductions can be attained by eliminating leakages at all stages of production and by installating equipment for removing unsaturated chlorinated hydrocarbons. The 1-km sanitary clearance zone now prescribed for synthetic rubber plants is inadequate; it is recommended that such plants, especially plants using acetylene as the basic raw material should be located 5-10 km from populated areas. (Author conclusions modified)

3525 APTIC NUMBER 21190

STANDARD ENVIRONMENT RELATED WITH CARBON MONOXIDE. (Issanka tanso ni kakaru kankyo kijun ni tsuite). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 6(4):249-268, April 25, 1970. 8 refs.

The Japanese air quality standard for carbon monoxide specifies that the hourly mean value must be below 20 ppm in eight successive hours and below 10 ppm in 24 successive hours. The standard applies to all areas of the living environment except highways and parking lots. The nondispersive infrared analyzer has been adopted as the measuring device, although other methods that yield comparable results may be eventually approved. Attainment of the CO standard requires not only the reduction of CO in motor vehicle exhaust but also the reduction of total pollutants in the exhaust; reductions in CO alone would increase the nitrogen oxides. Air pollution by carbon monoxide depends on the design and condition of automobiles, the structure and condition of roads, the volume of traffic, and on weather. Therefore, it is recommended that limits be established for carbon monoxide in engine exhaust; that cars be subject to inspection; that drivers be acquainted with principles of engine operation; and that traffic control be examined. Among the topics summarized in the tables and graphs included in the article are the following: changes of automobile production in leading nations, changes in fuel consumption in Japan, the number of automobiles per livable area per nations, results of measurements of carbon monoxide in Japan and America, the relations of traffic volume to carbon monoxide, and the allowed density of carbon monoxide in the living environment per nation.

3526 APTIC NUMBER 20337

Yada, Osamu
APPRAISEMENT OF GASEOUS POLLUTANTS. (Gasujo osenshitsu no hyokaho). Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 7(6):13-18, March 1, 1970. 17 refs.

Standards for evaluating gaseous pollutants differ according to the properties of particles and the environment. This review discussed the existing environmental standards for sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, hydrogen sulfide, hydrocarbons, and carbon dioxide. Concentration limits for air pollutants need to be based on a study of their long-term effects on man, animals, and plants. Moreover, an air quality standard for one region can be created only by obtaining data from that area. Sulfur dioxide gas is generated by the combustion of coal and heavy oil. Changes in its concentrations, as influenced by weather conditions, must be recorded to evaluate the degree of sulfur dioxide air pollution. There is not yet sufficient data on corrosion by sulfur dioxide, but active carbon filters are sometimes needed to reduce its corrosive effects. Carbon monoxide is generated by the incomplete combustion of organic compounds. The product of carbon monoxide (ppm) and time (hour) forms an index of poisoning, and the product should be less than 100. Ten percent is the limit of COHb (equals 0.5 plus one-fifth of carbon monoxide in exhalation). Warnings are to be given when nitrogen dioxide reaches 3 ppm, 5 ppm and 10 ppm, respectively. Ozone (more than 0.1 ppm) causes headache, and at more than 1 ppm injures respiratory organs. Hydrogen sulfide induces general discomforts at 1-3 ppm, stimulates eyes and respiratory organs at 10 ppm, and nerves at 50-100 ppm. No standard of hydrocarbons for man has been established. The carbon dioxide standard for rooms is 1000 ppm; adopting this to air pollution raises problems.

3527 APTIC NUMBER 21122

Terabe, M.
A REVIEW OF AIR QUALITY STANDARDS FOR PARTICULATE MATTER IN FOREIGN COUNTRIES. (Kaigai niokeru fuyufunjinto no kankyo kijun nitsuite). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 8(1):8-12, April 1, 1970. 6 refs.

As required by the Basic Act for Public Nuisance Countermeasures, enviromental standards have been specified for sulfur oxides in (Feb. 1969) and carbon oxides (Feb. 1970). A standard for particulate matter is now under consideration. Particulate standards in foreign countries fall into three categories: criteria for air quality, guides or goals for countermeasures, and emission standards. A. C. Stern's program for planning an air quality standard is explained. Pollution due to the particulate matter is classified according to particle size. Factors considered in the United States in establishing criteria for air quality standards are listed. The effects of particulate concentration and duration of exposure on human health, as noted in American studies, are shown. The Japanese standard for particulate matter will probably require that (1) the number of days when the 24-hr average is less than 0.15 mg/N cu m exceed 50% of the total number of days in a year when the measurement is made and (2) the number of days when the 24-hr average is less than 0.3 mg/N cu m exceed 95% of the total number of days in a year when the measurement is made. Standards in other countries, especially in the United States, are described.

3529 APTIC NUMBER 21125

VDI (Verein Deutscher Ingenieure) Kommission Reinhaltung der Luft, Duesseldorf, Germany
PERMISSIBLE CONCENTRATIONS OF NITROUS GASES. (Maximale Immissions-Konzentrationen MIK Nitrose Gase). VDI (Ver. Deut. Ingr.) Richtlinie, no. 2105, May 1960. 24 refs. Translated from German. 9p., 1962.

The Permissible Emission Concentrations, (PEC values) set by VDI are defined as those concentrations of pollutants in layers of the open air close to the ground which may be considered harmless, according to current knowledge, to man, animal, or plant during exposure of a given frequency and duration. These values are valid only within certain ranges, only when the pollutant occurs by itself rather than in mixture with other pollutants, and only for the open air outside of an emitting location. Nitrous gases occur in nature from electric discharges in the atmosphere; technologically, they are produced from such principal sources as the manufacture and processing of nitric acid and from internal combustion engines, explosives, and celluloid. Nitrous gases, which are recognizable by their brown color and characteristic odor, comprise the following nitrogen oxides and their compounds: nitrogen monoxide (NO); dinitrogen trioxide (N203); nitrogen dioxide (NO2); and dinitrogen tetroxide (N204). The latter two are the primary carriers of the toxic action of nitrous gases. The PEC half-hour mean value set for continuous exposure to NO2 is 0.5 cm3/m3. The PEC for intermittent exposure (permissible excess above the PEC for continuous exposure) is 1.0 cu cm/cu m half-hour mean value, three times daily. In the transition from normal air into an atmosphere containing NO2, the olfactory threshold lies at 0.1 cu cm/cu m (calculated as NO2) and the odor becomes characteristic at 0.5 cu cm/cu m, although within 5-6 min olfactory perception disappears even at 20 cu cm/cu m. Minor symptoms of irritation such as dry and rough throat may occur under prolonged inhalation of 1-2 cu cm/cu m; with repeated exposure, these become less and finally disappear even after inhaling 20 cu cm/cu m for 2 hrs. Toxic effects of nitrous gases on man and animals have not been differentiated; in plants, it appears that even sensitive plants sustain no damage from exposure to a mean concentration of 1 to 2 cu cm/cu m.

LEGAL AND ADMINISTRATIVE

3529 APTIC NUMBER 21930

Belke, K.
PREVENTION OF AIR POLLUTION DUE TO TRAFFIC. GENERAL SURVEY WITH EMPHASIS ON LEGAL RESTRICTIONS OF AUTOMOBILE EMISSIONS. (Luftreinhaltung im Strassenverkehr. Allgemeiner Ueberblick unter Beachtung rechtlicher Fragen auf kraftfahrzeugtechnischem Gebiet). Text in German. VDI (Ver. Deut. Ingr.) Ber., no. 149:49-56, 1970.

In 1968, 15 million automobiles were registered in West Germany and this number is yet to increase. Gasoline engines emit primarily carbon monoxide and hydrocarbons; while diesel engines tend to produce soot. Exhausts also contain the oxides of sulfur and nitrogen, benzo-3,4-pyrene, and tetraethyl lead. The Man-Air-Ox method for afterburning unburned exhaust components has attained significance among the anti-emission measures. Efforts to limit the fuel supply to a quantity which can be burned completely with the available air quantity have been successful. Dosed fuel has been injected in diesel and otto engines which has the advantage of uniform distribution of the fuel to the various cylinders. Improvement of carburetor design also helps to limit exhaust emissions. Blowby from the crankcase is drawn in by the engine and burned instead of being thrown into the air. All passenger cars with a piston displacement of more than 250 cu cm and all other vehicles with a piston displacement of more than 800 cu cm are subject to regulations concerning exhaust and blowby emissions. The maximum allowable concentration for CO has been set at 25g/100g fuel consumption and 1.5g for hydrocarbons.

3530 APTIC NUMBER 20426

Carlin, Alan
THE IMPLICATIONS OF GEOGRAPHIC-SPECIFICITY FOR AIR POLLUTION ABATEMENT STRATEGY. Preprint, 6p. 1969, 4 refs. (Presented at the Symposium on Development of Air Quality Standards, Los Angeles, Calif., Oct. 23-25, 1969, Paper p-8237, sponsored by the N Tuberculosis and Respiratory Disease Associations of Southern California.)
CSFTI, DDC: AD 696806

An auction of air pollution permits to emitters for each critical pollutant in a given air basin appears to offer advantages over either the administrative or emission charge strategies if the geographic-specificity problem is ignored. The idea would be for each pollution control authority to determine which air quality standards were being exceeded, to establish progressively smaller annual limits for the emission of the corresponding pollutants by specified categories of emitters until the desired air standards are met, and then to auction off permits corresponding to these limits. If locational factors are considered, then restricted auctions with minimum bids equal to the computed emission charges for each district and emission limit would appear to be optimum. The permits would also only be needed during critical air pollution periods.

3531 APTIC NUMBER 21435

Clement, J.

THE AIR POLLUTION PROBLEM IN THE PORT AREA OF ANTWERP. (Het problees van de luchtverontreiniging in het havengebied van Antwerpen). Text in Belgian. Preprint, 4p., 1968. (Presented at the International Harbour Congress 5th, Antwerp, Belgium, June 2-8, 1968.)

The importance of the air pollution problem has increased seriously as a result of the rapid industrialization of the port of Antwerp. A review is given of the measures taken to combat pollution. Since 1957, measurements on a small scale were conducted by the municipality. In 1967, a network of 25 semi-automatic instruments for the measurement of smoke and sulfur dioxide in the Antwerp area was established. Although a law against air pollution exists, it cannot be applied, since the necessary administrative regulations have not been published yet. In the meantime, use is made of the General Regulation on the Protection of Labor, which requires a license for the establishment of industries which may cause air pollution. The emissions of noxious substances resulting from defects or fires in industries and ships are also closely watched.

3532 APTIC NUMBER 20462

ANTI-SMOG REGULATIONS. (Norme anti-smog). Text in Italian. Collezione Legale Pirola, no. 1278, 110p., 1969.

A compilation is presented of related documents issued by various branches of the Italian government. A law of July 13, 1966 called Measures Against Air Pollution specifies the organizational machinery for an anti-pollution campaign and gives norms for heating plants, fuels, surveillance of pollution sources, industrial norms, and motor vehicle regulations. A decree of November 23, 1967 of the Ministry of Health divides the various areas of Italy into 'A' and 'B' zones, to differentiate the various communities according to the severity of their air pollution problems. Zone 'B' contains the larger population centers and those judged by the Central Committee to be more seriously affected. A presidential decree of October 24, 1967 is an administrative implementation of the law of July 13, 1966 and relates to the regulations affecting heating plants. It specifies such technical matters as plant location, fuel containers, chimneys, burners, permissible emission limits, and type of fuel used. Directions are also given for taking fuel samples and their analysis. A ministerial circular of May 28, 1968 gives safety standards for application in the planning, installation, and use of heating plants using fuel oil and gas oil. A ministerial circular of January 7, 1969 clarifies some isolated statements made in the earlier documents relating to changes made by heating plants in their output or in the type of fuel used.

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3533 APTIC NUMBER 21177

Dreyhaupt, F. J.
MEANS AND AIMS OF EMISSION INSPECTION. (Mittel und Ziele behoerdlicher Emissionsueberwachung). Text in German. VDI (Ver. Deut. Ingr.) Ber., no. 149:33-40, 1970.

Source inspection is necessary to protect neighboring residential areas against the hazards of air pollution, while monitoring of emissions aids in determing casual connections in cases of harmful effects. It provides the basis for setting up emission standards. Emission monitoring inside the plant is a regular task, best done by continuous techniques, although the recording units are expensive which limits their use to large industrial complexes. Mostly, the emissions are measured in regular intervals by experts under the most favorable conditions; which still does not provide, sufficient information on the true situation. For source inspection from outside the plant, the Ringelmann chart, TV-cameras, a light detection and ranging lidar system can be used. Unfortunately, the Ringelmann chart is not widely respected in West Germany and without other proof of excessive emissions, no summons can be distributed by inspectors. At present only aerosols can be measured in smoke plumes with the lidar technique, but developmental work is underway to expand this technique for the measurement of gaseous components. A description of the technique is given.

3534 APTIC NUMBER 20273

Fletcher, R. H.
KITIMAT POLLUTION CONTROL BY-LAW. Pulp Paper Mag. Can. (Quebec), 71(7):78-90, April 3, 1970. (Presented at the 5th Paper Industry Air and Stream Improvement Conference, Toronto, Ontario, Oct. 21-23, 1969.)

Land use in the 16-yr-old town of Kitimat, B. C., was planned to minimize the conflicts that can exist between residential areas and industry. Prior to the advent of a pulp and paper complex with a 930 tpd Kraft mill and a 150 million fbm per year saw mill, the town's principle industry was an aluminum smelter. To preserve the quality of its environment, the town passed a waste emission by-law that requires the monitoring of selected emissions from the pulp mill and smelter. The law, to become effective in December 1970, identifies a tolerable level of pollution which is expected to be met, but no exceeded, by the two industries. The level of emission from an industry is related both to the type of equipment used and to the way in which it is operated. The levels, determined from experience recorded elsewhere and those found tolerable by local authorities in an assimilation study, are as follows: cinders from power boilers, 150 gr per 1000 cu ft; sodium compounds, 200 gr per 1000 cu ft. all particulate matter; volatile organic sulfur compounds, 0.2 lbs/ton; calcium compounds, 250 gr per 1000 cu ft all particulate matter; and volatile fluorine compounds, 2.5 lbs/ton.

3535 APTIC NUMBER 21431

Gonschorek, Dietmar and Gerhard P. Mueller
FEASIBILITIES AND LIMITS OF FINANCIAL PENALTIES FOR AIR POLLUTERS. (Moeglichkeiten und Grenzen oekonomischer Regelungen zur Reinhaltung der Luft). Text in German. Chem. Tech. (Berlin), 22(3):158-161, March 1970.

In an industrial center, the effect of financial penalties for air polluters was studied. Limit concentrations were worked out according to the individual meteorological and topographical conditions. High penalties were collected for exceeding these limits which were used for air pollution studies. After two years, it was shown that not all excessive emissions could be limited this way. Power plants frequently were unable to cope with their emissions within reasonable expenditures. Completely new plants are required in order to reduce the emissions to the required limit. For the chemical industry, the penalties were too low to be incentive. But between these two extreme cases, there were those which found it less expensive to install control facilities than pay the penalties.

3536 APTIC NUMBER 21502

Grant, Eric P.
CALIFORNIA AIR POLLUTION CONTROLS IN TRANSITION. CALDEA Calendar, 15(2):8,26, Jan. 1968.

Control systems have been on California automobiles since the introduction of the 1966 models, and they have reduced the total emissions from vehicles by near 70% for hydrocarbons and about 50% for carbon monoxide. Without vehicle controls, there would be 2 million gallons of hydrocarbons going into the California atmosphere each day. Enormous improvements in the quality of exhaust control equipment have been made since installation of the first systems, and quality audit programs have improved in which representative samples of engines sizes and transmissions are tested for pollutant emission levels. The Air Resources Board has been directed to divide the State into regional air basins, establish air quality standards for these basins, coordinate smog research and control programs, and administer Federal grants. Insofar as the auto emission control program is concerned, the ARB can be expected to direct itself to the following: the early institution of hydrocarbon emission standards in the area of 100 ppm; elimination of the averaging concept in favor of an absolute maximum allowable standard applicable to each and every California-registered automobile; increased rapport between the ARB, the California Highway Patrol, and the Department of Motor Vehicles in a resolution of enforcement problems; the abatement of nitrogen oxide emissions; and elimination of diesel smoke and odor.

3537 APTIC NUMBER 20882

Grochulski, J.
DECREE ON PROTECTION AGAINST AIR POLLUTION. Monitor Polski (Warsaw), no. 32:381-385, June 15, 1967. (Item 152.) Translated from Polish. 13p.

The text is given of an order from the Central Water Utilization Bureau, dated May 30, 1967, concerning the width of protective zones established for protection against air pollution. Some 280 manufacturing plants which emit pollutants are classified according

to type of production in one of five widths of protective zones: 1000, 500, 300, 100, and 50 m. The width of the zone is measured in terms of a straight line from the source of pollution. Variances are permitted for individual plants if justified by circumstances of local climate and topography, emission concentration, production technology, and plant purification facilities.

3538 APTIC NUMBER 20356

CZECHOSLOVAKIAN LAW OF APRIL 7, 1967, ON AIR POLLUTION CONTROL. (Legge Cecoslovacca del 7 Aprile 1967 sulla lotta contro l'inquinamento atmosferico). Text in Italian. Ing. Sanit., 16(6):460-463, Nov. - Dec. 1968.

In a series of 19 articles, the Czechoslovakian law defines air pollution; imposes a series of taxes and fines on offending industries and the procedures for collection of such monies; and designates the Ministry of Forests and Waters as the agency responsible for air pollution programs, methods of measurement, and scientific and technical research on the subject. An Inspectorate is instituted the functions of which are to inspect purification plants and their construction, to determine the content of noxious substances, to give council to industry on air pollution problems, and to enforce the payment of taxes and fines. Tables are given of acceptable emissions of fly ash and sulfur dioxide; a list is given of 20 substances considered noxious, together with their permissable limits in the atmosphere.

3539 APTIC NUMBER 21104

Japanese Ministry of Health and Welfare, Tokyo
AIR POLLUTION CONTROL LAW (1968). (AMBIENT AIR QUALITY STANDARDS FOR SULPHUR OXIDE.) EMISSION STANDARD). P. L. 97, 50p., June 10, 1968.

Regulations are presented to control sulfur oxide emissions in soot and smoke from industrial and vehicle exhaust sources. The Ministers of International Trade and Industry and of Health are empowered to established emission standards applicable to individual 'designated areas.' After a 2-year compliance period, violators are subject to fines and, in some cases, imprisonment; in additions, operations of the emitting facilities are temporarily suspended. Provisions are made for cases of accidents or emergency situations. The Minister of Transportation provides the allowable limit for vehicle exhaust emissions. An expert mediation panel is established to adjudicate civil cases resulting from damages caused by pollution. An enforcement order issued by the Cabinet on Nov. 30, 1968 includes a list of specified noxious substances, and set 0.2 ppm as the highest hourly value for atmospheric sulfur oxides permissible during a year, or 0.06 ppm in the annual average of hourly values. Size or capacity of specified types of boilers and furnaces are enumerated. Supplementary orders include a formula for calculating standard limits for sulfur oxide discharge, exhaust limits for combustion equipment, limits for carbon monoxide from vehicles, environmental quality standards of sulfur oxides for public health, 5- and 10-year goals for environmental improvement, research objectives, calculation of stack heights, and various policy and enforcement decisions and amendments.

3540 APTIC NUMBER 21161

Kelly, C. T.
L.N.G. STORAGE: SPACING RULES. Petrol. Times, vol. 66:739, Dec. 14, 1962.

In the past two months, space rulings for the storage of liquefied natural gas (LNG) were published by governmental bodies in France and the United States. The publications point out that the area of a LNG site need not be as huge as that recommended by the Bureau of Mines in 1946. The French regulations require that local governments be provided with information about three sorts of land use: in a strip extending 40 m or 164 ft on both sides of the gas pipelines; within a radius of 100 m or 328 ft about the points of reception and regasification of the LNG; and in a circle of radius 800 m or 1/2 mile, with the storage at its center. The last distance can be reduced to 400 m or 1/4 mile if the storage facility is underground. The local government can modify any operation or construction material in the interest of safety. The U. S. situation is more relaxed; the Bureau of Mines concluded that LNG can be stored confidently in suitably designed above-ground tanks surrounded by earthen dikes in such the same manner as gasoline. Inter tank separations and distances to inhabited buildings should be of the same magnitude as with gasoline.

3541 APTIC NUMBER 21520

Lang, Hans J.
SIMPLIFIED APPROACH TO PRELIMINARY COST ESTIMATES. Chem. Eng., vol. 55:112-113, June 1948.

A method is developed to quickly obtain a good approximation of overall plant cost when only the cost of equipment delivered to the site is known. The estimate arrived at by this method generally will fall within 10-15% of that reached by a preliminary estimate based on flowsheets and layout drawings. Multiply the estimated cost of process equipment delivered to the site by 1.43 to give the installed cost of equipment including foundations, supports, chutes, vents, insulation, and installation. For solid processing, multiply this quantity by 1.10; for solid-fluid processing, 1.25; and 1.60 for fluid processing. This will give the installed cost of equipment and piping which then should be multiplied by 1.50 to get the total construction cost of the plant. To obtain the total overhead cost, the total construction cost is to be multiplied by 31% for solid processing, 35% for solid-fluid processing, and 38% for fluid processing. The sum of the total construction and the total overhead costs is the total estimated cost of the plant. Premium time is not included. Several examples are worked out, and the derivation of the estimating factors explained.

3542 APTIC NUMBER 20530

McFadden, Vincent D.
AIR POLLUTION AND FINISHING. Ind. Finishing (Indianapolis), 43(9):28-30,32,34, Aug. 1967.

Studies conducted in Los Angeles, using a smog chamber, revealed that organic solvents of the type used in coatings are the cause of about 20% of the total organic emissions. Rule 66, which was consequently enacted, is considered in its application to industrial finishings. Coatings baked, heat cured or heat polymerized, regardless of the type of solvent used, are limited to no more than 15 lbs per day from each operating setup, and air-dried coatings in which photochemically reactive solvents are used are limited to 40 lbs per day. Some of the following more common solvents are restricted: xylene, toluene, MIBK, DIBK, mineral spirits, ethyl amyl ketone, Solvesso 100, and hi-flash naphtha. Regulation No. 3 in San Francisco basically follows the form of Rule 66, but it tolerates more solvents; suppliers shipping quantities of photochemically reactive agents in the Bay Area in 55-gallon containers or larger must register this delivery with the San Francisco Air Pollution Control District.

3543 APTIC NUMBER 20493

McMullen, J. J.
A SYSTEMS APPROACH TO THE MARINE TRANSPORTATION OF LNG. Inst. of Gas Technology, Chicago, Ill., Proc. Intern. Conf. LNG, 1st, Chicago, Ill., 1968, 15p. (April 7-12, Session no. 6, Paper 36.)

To insure the successful and most profitable introduction of liquefied natural gas (LNG) into the world fuel markets, a total systems approach to ocean transport of LNG must be employed, combining market analysis, naval architecture, marine engineering, low temperature heat transfer and hull structural design, economics, systems analysis, knowledge of the codes and regulations of the classification bodies and regulatory agencies, and risk analyses. Cost of delivered LNG is strongly influenced by the selected ship size, speed, and type of cargo tank, while ship size and speed significantly influence shore facility and harbor terminal costs. Natural gas must compete in the fuel market with power from other sources with different transportation requirements, and transportation costs become critical to the successful entry of LNG into the major markets. (Author abstract modified)

3544 APTIC NUMBER 21027

Neufang, H.
MAINTENANCE OF CLEAN AIR SEEN AS A TASK FOR PROPER PLANNING IN INDUSTRIAL CENTERS. (Luftreinhaltung als Standortfaktor in Ballungsgebieten). Text in German. VDI (Ver. Deut. Ingr.) Ber., no. 149:41-48, 1970.

As early as 1920 it was decided that large parts of forests, waterways, and meadows be set aside for recreational purposes. The construction plan of North-Rhine Westphalia for 1964 demands that industrial centers and residential areas be planned to avoid any large accumulation of air pollutants in the residental sections. For those areas already suffering from air pollution, domestic heaters were to be replaced by remote heating and green sections were to be created and the emissions limited. Industrial plants have been made responsible for reducing the emissions to certain emission standards set up by the state.

3545 APTIC NUMBER 20949

Osaka Prefectural Government, Japan
INSPECTION CENTER FOR PUBLIC NUISANCES. OUTLINE OF PLAN. 16p., July 1968.

A comprehensive control center for air pollution which is part of a larger inspection center for public nuisances (smoke, water pollution, and noise) built in Osaka, Japan, is described. The control center consists of 15 monitoring stations, one mobile monitoring unit, a digital telemetering radio system, and a digital computer. The control procedure is carried out in a sequence of detection, transmission, data processing, and control. The telemetering equipment in the monitoring stations transmit data every ten minutes; a single transmission takes six seconds. If high pollutant levels are detected or predicted, an alarm system sends a warning to the 100 largest emitters in the area. The factories must take appropriate actions immediately, either by changing the fuel or lessening the duration or level of operation according to previously agreed-upon methods. Patrol cars check and enforce these regulations. The data collected by the system will be used to establish pollution-meteorology relationships in an effort to predict smog conditions. A project is also being developed to use the computer to establish models and mathematical techniques for application in an improved air pollution control program. Equipment in the control center is outlined, and a detailed block diagram of the center and telemetering system is included.

3546 APTIC NUMBER 21438

Saito, M. and Ohira
MINISTERIAL ORDINANCE AMENDING THE AIR POLLUTION CONTROL LAW ENFORCEMENT PROCEDURES. (Taiki osen boshiho shikko kisoku no ichibu o kaisei suru shorei). Text in Japanese. Koseisho Tsushosangyoshorei Dai-nigo (Ordinance No. 2 of the Ministry of Health and Welfare and the Ministry of International Trade and Industry), 1p., May 27, 1969.

The enforcement regulation of the Air Pollution Control Law of 1968 was amended to add two more sections to Article 2 of the ordinance. The methods regarding the measurements of, as well as the calculation of the annual maximum and the annual average of the hourly values mentioned in Article 4 of the ordinance are specified. In addition, the same hourly values are as a rule to be measured over a two-year period at two observation points.

3547 APTIC NUMBER 20465

Saruta, Wamio
FOCAL POINT RESEARCH ACTIVITIES IN REGIONAL UNIVERSITIES, FROM THE VIEW POINT OF HYGIENE. (Chiiki daigaku ni okeru kenkyukatsudo

no mondaiten). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 23(1):31-34, April 1968. 7 refs.

Four cases are cited to show the unreasonable influence of centralized authority on research activity at local universities and institutes. The first case was an incident of ethyl lead poisoning that resulted in the deaths of six persons and in injury to 17 others. As determined by the Pharmaceutical Department of Kyushu University, the source of the poisoning was contaminated well water. The pressure exerted on the research group is critized. The second case concerned aircraft noise. Not only the people residing around the Itatsuke Airport, used as a U. S. Army Base, but also school children were bothered by the noise 24 hours of each day. A research staff composed of professors and graduate students at Kyushu University was organized to obtain precise data without any grant or financial aid from any sources; on the basis of the data, a recommendation to build a school from concrete was accepted. It is a commentary on government authority that later a group of eminent professors at Tokyo University was sent to investigate the aircraft noise under a research project grant. The third case related to the coal dust explosion at the Omuta Mitsui Miike Mine which resulted in 450 deaths. A joint research team was initially denied a government grant to investigate the accident. When a grant was issued, the author of the original proposal was not included in the investigative team. The Omuta River water-pollution problem represents a similar case of the interference of centralized authority with research activity. Continuing government interference in academic activities at local institutions may inhibit the initiative of specialists residing in remote places.

3548 APTIC NUMBER 21039

Sato, Pisaku
CABINET ORDER AMENDING A PART OF THE EXECUTION ORDINANCE OF AIR POLLUTION CONTROL LAW. (Taiki osen boshiho shikkorei no ichibu o kaisei suru seirei). Text in Japanese. Seirei Dai Sanbyakujuichigo (Cabinet Order No. 311), 3p., Dec. 25, 1969.

A cabinet ordinance specifies the renumbering of some of the sections of the Air Pollution Control Law Enforcement Ordinance as well as some additions to the list of pollutants. Some new cities are specified and changes are made as to the administrative procedures as mentioned in other sections of the ordinance. The major part of the ordinance is devoted to specifying various locations throughout Japan in reference to various parts of the ordinance.

3549 APTIC NUMBER 20999

Skelly, Joseph P.
THE AIR QUALITY SITUATION. Iron Steel Engr., 47(6):95-99, June 1970. 9 refs.

The technical and legal aspects of the national campaign to improve air quality are presented. The principle federal agency in the development of this program is the National Air Pollution Control Administration in the Dept. of Health, Education, and Welfare. Federal air quality, based on considerations of health, property damage, and cost are being established. The air quality program will be justified by cost benefit calculations in addition to health and aesthetic conditions. Relative effectiveness of the various types and methods now used for the collection of particulates remains much as it has for some time. At present, the gas cleaner manufacturer can predict performances, design a collector, and guarantee it with considerable confidence for outlet loadings of about five one hundredths grains/cu ft for particles larger than two micron. Considerable progress has been made in the lime injection process to remove sulfur oxides from stack gases. A number of other absorption processes are being studied, including some for removal of nitrogen oxides. A survey of the iron and steel industry is reviewed from a systems analysis and a cost analysis approach.

3550 APTIC NUMBER 21017

Uchihara, Shigemi
GOVERNMENT BUDGET FOR PUBLIC NUISANCE CONTROL PROJECT 1970. (Showa 45 nendo kogaitaisaku kankei yosanan ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 6(5):393-396, May 15, 1970.

Governmental pollution control projects 1970 are presented. One of the primary projects is to provide prefectural governors with a framework for pollution control programs. Other projects are as follows: the establishment and enforcement of ambient standards for protecting humans from atmospheric pollution, water pollution, and noxious noises and for preserving environment; establishment of national hygienics institutions engaged in research on pollution and public health; organization of an extensive monitoring network and consolidation of local monitoring systems, both of which are expected to carry out reciprocal work and exchange data; expansion of the control agency which provides loans and grants to finance the cost of control programs; and promotion of the relief program for victims of pollution. Also discussed are budgets for control adjustment, the budget for committee meetings, the budget for research on stack smoke and on development of land use, and the budget for local public health centers.

3551 APTIC NUMBER 20946

Wiethaup, Oberrechtsrat Hans
DUST ANNOYANCE BY AN UNPAVED ACCESS ROAD. (Staubbelaestigungen durch eine unbefestigte Hofzufahrt). Text in German. Gesundheitsw. Desinfekt. (Hamburg), no. 6, 2p., 1969.

The access road to a bottling plant was unpaved and consisted of compacted blast furnace slag. The road was traveled 120 times each day, stirring clouds of dust. To the North of the plant were 17 private homes. One of the owners of the homes filed suit against the bottling plant. The latter was requested to pave the road. The bottling plant appealed the decision on grounds that the vehicles traveling the road did not belong to the plant and that the calm air prevented rapid dispersion of the dust. The appeal was rejected and the plant had to pave the road.

3552 APTIC NUMBER 21096

Greenfield, S. M.
THE RESPONSIBLE ROLE OF THE ATMOSPHERIC SCIENCES IN DETERMINING THE FUTURE QUALITY OF MAN'S ENVIRONMENT. Preprint, American Meteorological Society, Boston, Mass., 10p., 1969. (Presented at the Symposium American Meteorological Society, The Future of the Atmosphere, Madison, Wis., Oct. 21, 1969.)

A new discipline is envisioned called Environmental Studies, which will respond to man's modification of his natural resources in a highly technical society. Man has created changes that range from air poilution due to the burning of fossil fuels to thermopollution from the removal of waste heat; in addition to their individual impact, it is evident that many of these areas of environmental injury continuously feed back, one upon the other. Ecological manipulations are directly affected by pesticide usage, and are indirectly affected by air pollution, water pollution, and land usage. Efforts to date have concentrated on understanding the dynamics of the problem, and almost no attempts have been made to examine the entire problem of environmental conservation and management.

3553 APTIC NUMBER 21816

Ui, Jun, Kyoichi Sonoda, and Nobuko Iijima
PROGRESS OF KOGAI CONTROL AND PUBLIC OPINION (II). (Kogaitaisaku no keisei to yoron (II). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 6(5):327-332, May 15, 1970.

Events and factors that have contributed to the current state of air pollution in Japan are reviewed. Pollution has been particularly influenced by social attitudes and by the physical and geographical factors. With respect to the latter, population density is so high that it parallels the density of atmospheric pollutants. The dumping of waste in the oceans off Japan has resulted in polluted sea water and pollution in coastal areas. Other physical and geographical factors are the shape of concentration of population on river banks, and difficulty in withdrawing rainwater for industry. Favorable meteorological factors, such as relatively good wind speed for pollutants dispersion, are offset by the complex topography and the length of atmospheric stagnation during rainy season. Social aspects which accelerated and intensified pollution are partly attributable to the support of war industries by military regimes prior to World War II, a pre-war educational system based on the priority of the military and poverty and conservatism prevailing in rural areas. Contributing post war developments were the rapid growth of the economy and industry, the double-character of economic system, and the distinctive relationship between employer and labor unions.

3554 APTIC NUMBER 20267

Watanabe, S. and K. Wakaba

PUBLIC ATTITUDES TOWARD AIR POLLUTION IN MURORAN. (Muroran no taiki osen ni taisuru jumin no taido ni tsuite). Text in Japanese. Taiki Osen Kenkyo (J. Japan Soc. Air Pollution), 4(1): 68, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

A public opinion survey on air pollution was conducted in Muroran, Hokkaido in 1967. Out of a total of 230 households interviewed in the polluted and the control areas, 191 responded. The numerical results are tabulated and the general conclusions are as follows: in the polluted area, many wished to move to a cleaner place; the complaint rate (both voluntary and response to leading questions) was much more signficant in the polluted area; the general knowledge on air pollution was not high; although a substantial number of residents in the polluted area proposed the formation of a citizens action group, many accepted air pollution as inevitable; the responses did not differentiate between the people related to the polluting industry and those unrelated.

3555 APTIC NUMBER 20528

Zabor, Marge and Carl Hansen
A SURVEY OF MENSA MEMBERS ON BUSINESS INVOLVEMENT WITH SOCIAL PROBLEMS. Mensa Res. J., 1(2):15-20, Oct. 1969.

A survey was undertaken early in 1967 to determine the attitudes of Mensans on business involvement with social problems, and a questionnaire was mailed to a random selection of 988 members, 536 of whom returned useable replies. Of the 13 questions asked, only three dealt directly with the ostensible objective of the survey; one asked about automation and nine about advertising and publicity (media, copy themes, and public image). While three-quarters of the sample said that it favored greater business involvement in social problems, when given an opportunity to select a topic of discussion with the president of a specific company, the respondents generally chose a subject dictated by the company's public image (DuPont: Future Technology; A.T.&T.: Service Improvements and Rates; General Motors: Future Technology and Auto Safety; Local Transit Companies: Service Improvements and Urban Society). It is

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3556 APTIC NUMBER 20548

Dreisbach, Robert H.
AIR POLLUTION. In: Handbook of the San Francisco Region. Palo Alto, Calif., Environment Studies, 1969, p. 284-309. 29 refs.

The major types of air pollutants in the San Francisco Bay area, and their sources and effects, are discussed. Such respiratory diseases as bronchitis, emphysema, influenza, pneumonia, and tuberculosis have a close relationship with the level of air pollution. A strong correlation of lung cancer exists in men who smoke, and the incidence of lung cancer in California has increased from 15/100,000 in 1950 to 26.7/100,000 in 1967. Automobiles are the largest source of carbon monoxide. The presence of CO in the blood reduces the availability of oxygen to the tissues in two ways: by direct combination with hemoglobin to reduce the amount of hemoglobin available to carry oxygen, and by preventing the release of some of the oxygen at the low oxygen partial pressure present in body tissues. It is believed that long-term exposure to CO may contribute to chronic disease. Missile fuels, explosives, cigarettes, and agricultural wastes liberate nitrogen oxides. Long exposure to 50 ppm nitrogen dioxide has caused inflammatory changes in the lungs, and higher concentrations have been fatal. Sulfur oxides come from fuel oil combustion, petroleum refining, and from the chemical and metallurgical industries. Hydrogen sulfide is produced by bacterial action on sewage effluents containing large amounts of sulfur compounds, and it can cause eye irritation and sensory loss. The constituents present in particulate matter include lead, beryllium, carbon, other metals, and organic particulates. Their sources and effects on human health are also discussed.

3557 APTIC NUMBER 21289

Effenberger, Ernst
AIR POLLUTION, A PROBLEM OF HYGIENE. (Die Verunreinigung der Luft, ein Problem der Hygiene). Text in German. Z. Allgemeinmed., 46(6):283,-293, 1970. 43 refs.

Fuel oil consumption in the Federal Republic of Germany increased from 1.37 million tons in 1954 to 48.16 million tons in 1967; mineral oil consumption rose from less than 5 million tons in 1950 to more than 90 million tons in 1970; and hard coal consumption declined somewhat in the years between 1950 and 1967. The increasing use of natural gas was not high enough to have a profound impact on the air pollution situation. A great deal of sulfur dioxide and fly ash is produced through domestic heating. Otto engines emit carbon monoxide, aldehydes, numerous hydrocarbons, nitrogen gases, and oxidation products of various additives such as lead. Diesel engines emit primarily nitrogen gases. In connection with adverse weather conditions such as inversions, air pollutants may cause such episodes as those in the Meuse Valley in 1930, Monongahela Valley in 1948, and London in 1952. The Technical Directives for Maintenance of Clean Air set the maximum allowable atmospheric concentrations for dust in residential areas at 420 mg/sq m/day (average annual value) and 650 mg/sq m/day (average monthly value), and in industrial areas at 850 and 1300 mg/sq m/day. The maximum allowable atmospheric concentration for SO2 is 0.4 mg/cu m air (long-term value). A short-term concentration of 0.75 mg/cu m is admissible. Sulfur dioxide is known to affect the respiratory tract. It can be removed from flue gases by absorption, adsorption, and by catalytic processes. Average carbon monoxide concentrations of 0.005% by volume were measured in the air above Chicago and Hamburg; 0.007% in Moscow; and 0.008% in Berlin. Benzpyrene measurements in Hamburg in December 1961 revealed a maximum value of 316 micrograms/1000 cu m air (1050 microgram 3,4-benzpyrene per gram dust were measured). In summer, the concentrations were below 20 micrograms/1000 cu m air. A correlation has been found between lung cancer and the benzpyrene concentration of the ambient air.

3558 APTIC NUMBER 21682

Field, A. A.
WHAT'S NEW IN EUROPE--TALL CHIMNEYS. Heating, Piping, Air Conditioning, 42(4):125-126,128, April 1970.

In order to dilute and spread sulfur dioxide, many companies in Europe are using taller chimneys with higher gas exit velocities, which prevent downwash on the lee side of the chimney and stop inversion from taking place within the chimney itself. Chimneys as tall as 1000 ft are being constructed out of enameled steel, aluminum cladding, and precast concrete. Legislation in certain European countries requires minimum gas exit velocities, with stack height being a function of sulfur dioxide output and the existing level of contamination in the district. A problem encountered with the tall stacks is precipitation of sulfuric acid, which corrodes metal. Insulating the stack prevents this, but it is expensive. Other methods to eliminate this problem are injecting dolomite powder into the combustion chamber, plastic chimney construction, and using fluidized lime particles as the combustion bed.

3559 APTIC NUMBER 21618

Jackson, K. R.
CHIMNEYS AND FLUES. Heating Ventilating Engr. J. Air Conditioning (London), 42(493):57-61, Aug. 1968.

Information concerning material selction for the construction of chimneys, flues, and liners is presented. For use in all three, the list of principle materials consists of steel, brick, glass fiber, and concrete. Two additional materials, asbestos and loose-fill insulation, are considered as lining material only. The technical suitability from the standpoint of chemical and thermal considerations for each material are discussed, as well as economic and aesthetic considerations. Steel is considered superior to both brick and concrete where the chimney is subjected to frequent thermal excursions and where weight is a factor. Glass fiber is outstanding for its corrosion resistance but is severely limited in the temperatures to which it can be exposes. Brick, in its many formulations, is probably the most commonly used material; it is most suitable for

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chimneys less than 250 ft high. For extremely tall stacks, concrete is usually selected.

3560 APTIC NUMBER 16578

Johnson, David Larry
UNIT ON AIR POLLUTION. Thesis (M.S. Ed.), Utah Univ., Salt Lake City, Dept. of Science Education, August 1968, 168p. 109 refs.

Information was obtained on the various types and sources of air pollution and their effects on animal and plant life for use as a teaching unit on air pollution. The evolution of the atmosphere was traced from its beginning to the present and then analyzed. Common natural air pollutants such as particles from sea spray, volcanic erruptions, meteoric dust, natural combustion, terrestrial dust, pollen, bacteria, and fungal spores were discussed. Unnatural air pollutants which include particulate matter, sulfur oxides, nitrogen oxides, hydrocarbons, and carbon monoxide were discussed with reference to transportation, manufacturing, electric power generation, space heating, and refuse disposal. The effects of air pollution on such diseases as emphysema, chronic bronchitis, and cancer were presented, as well as the effects on vegetation. Many agricultural areas were destroyed for the cultivation of many sensitive species by the continual presence of pollutants. Extensive damage has resulted to many forest species in areas where controls were not used for escaping pollutants. Methods being employed to combat air pollution were listed as inertial separation, scrubbing, agglomeration, adsorption, and engine modifications to reduce tailpipe exhaust emissions. Advances in the development of engineering control devices are expensive and not totally effective. Controls are not developed for many processes. Other methods of control such as zoning, site selection, performance standards, and regional air-shed developments were proposed as effective methods of pollution abatement. (Author abstract modified)

3561 APTIC NUMBER 21323

Matsuda, Matsuo
THE EFFECT OF THE MULTIPLE STACK. (Shugoentotsu no koka). Text in Japanese. Anzen Kogaku (J. Japan Soc. Safety Eng.), 8(6):321-329, Dec. 15, 1969. 8 refs.

The multiple stack effectively diffuses atmospheric pollutants and is economical to build. The principle of dilution by diffusion of the plume is explained on the basis of the Bosanquet theory. Two types of multiple stacks are shown. In one, the exhaust from multiple installations is led to the bottom of one stack. In the other, a stack is provided for each installation: the stacks are connected with each other to form a framework at the top of which all of the stacks are joined together to form an exit. Building costs are lower for the first type. However, when some of the installations are out of operation, the efficiency of the stack is lowered because of downwash. Moreover, inspection and repair of the stack necessitates the shutdown of all installations. Nevertheless this type of multiple stack is widely employed in almost all countries except England, where the latter type is used. The economy of the multiple stack is discussed, and existing examples are shown. When stacks are connected to form a framework, they are placed at the center of a steel tower, or the stacks themselves are utilized as members of the tower. This type of the tower is advantageous with respect to weight, but it must be borne in mind that a difference in thermal elongation occurs among the stacks when some are not operating.

3562 APTIC NUMBER 21360

Northwestern Univ., Evanston, Ill., Committee on Environmental Policies
ON ACHIEVING CLEAN AIR. 33p., April 21, 1970. 60 refs.

The concern of the ad hoc committee on Environmental Policies has been air pollution in Chicago. Sulfur dioxide and particulate matter are the only pollutants presently monitored in Chicago. Other pollutants include carbon monoxide, sulfuric acid, and nitrogen oxides. It is recommended that H2SO4 levels be monitored in view of the probate connection of this substance with toxic effects of pollution. Commonwealth Edison Co. should be encouraged to continue with reduction in the burning of high sulfur fuels, and should begin to monitor radioactivity in the vicinity of its power plants. Improvements in existing particle removal facilities should be implemented, and the electrostatic precipitators should be upgraded with respect to the weight of particles removed. Commonwealth Edison should contribute financial support to intra-industrial cooperative research leading to improved SO2 removal systems, nitrogen oxide removal systems, and processes for the removal of particulates less than 1 micron. Abatement policies should not rely on any single method of control. Technologies of fuel substitution, demand reduction, installation of precipitators of high efficiency, and elemental sulfur removal should all be explored. Management should concentrate its attention on both consumers and stockholders, to permit changes in abatement policy. The socio-economic problems of air pollution abatement are also discussed.

3563 APTIC NUMBER 21287

MAINTENANCE OF CLEAN AIR. (Reinhaltung der Luft). Text in German. Oel Gasfeuerung, 14(10):1020-1024, 1969.

The major sources of air pollutants are industries, vehicles, and domestic heating. In the industrial sector, power plants, cement kilns, steel plants, and the chemical industry are the primary sources for pollution. Air pollutants may affect humans, animals, and plants. The harmfulness of dusts is determined by their composition, grain size, and shape. Fine dust particles which penetrate into the lungs are particularly dangerous. Soot requires special attention because it may be a carrier of toxic and carcinogenic substances. The most dangerous gaseous pollutants are carbon monoxide, sulfur dioxide, fluorine, chlorine, and unburned hydrocarbons. The federal government is sponsoring a program of air monitoring and research and development; it took legal measures to avoid or reduce air pollution. Large industrial plants must fulfill stringent

regulations laid down in the 'Technical Directives for the Maintenance of Clean Air'. The federal law on preventive measures for the maintenance of clean air requires the installation of automatic measuring stations in industrial centers. Automobile exhausts, too, will soon be subject to regulations.

3564 APTIC NUMBER 20495

Research Triangle Inst., Research Triangle Park, N. C., Engineering and Environmental Sciences Div.
APPLICATIONS OF AEROSPACE TECHNOLOGY IN AIR POLLUTION CONTROL. (FINAL REPORT). NASA Contract NSR-34-004-056, RTI UE-411-3, 65p., June 1969.
CFSTI: N69-36186

The Technology Application Team of the Research Triangle Institute, Research Triangle Park, N. C. acts as an information and technology interface between the National Aeronautics and Space Administration and National Air Pollution Control Administration and as a catalyst among the various sources of information involved in the technology. It identifies very specific technology-related problems and prepares air pollution problem abstracts on each specific requirement which describes the problems in a concise manner using functional nondisciplinary terminology. The specifically described problems include automobile drivers performance tests; remote temperature and wind vector sensing techniques for the lower 2 km of the atmosphere; long-term geophysical effects of carbon dioxide and of particles in the 0.2 to 0.5 micron size range; development of advanced pollutant sensors for methane, sulfur dioxide, fluorine, carbon dioxide, total hydrocarbons, carbon monoxide, nitric oxide, nitrogen dioxide, and total oxides of N2; improvement of adsorption and absorption techniques for removing pollutants from carrier gas streams; instrumentation for the investigation of flame chemistry; effect of trace qualitites of metals and impurities on pollutant identity and output in combustion; analytical techniques for the trace metals in combustion effluent and waste gases from metal processing, both in collected particles and in situ; fluidized bed combustion processes; working fluids for Rankine cycle engines; heat transfer to small gas-borne particles; physical consideration in optimizing fuel-air mixture; measuring techniques for air-borne particulates; and gas exchange capacity of lungs. Other problems mentioned, but not specifically described are oder classification and identification; development of advanced pollutant sensors for As, Be, Hg, Ni, NH3, carcinogens, Cl and HCl, H2S, V, ozone, Br, Ce, F, I, Pb, reactive hydrocarbons, and Cd; holographic techniques for measuring particulate flux, and combustion chamber aerodynamics.

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